INTER AVIA

Review of World Aviation

In this Issue:

New Year Thoughts by a Contemporary

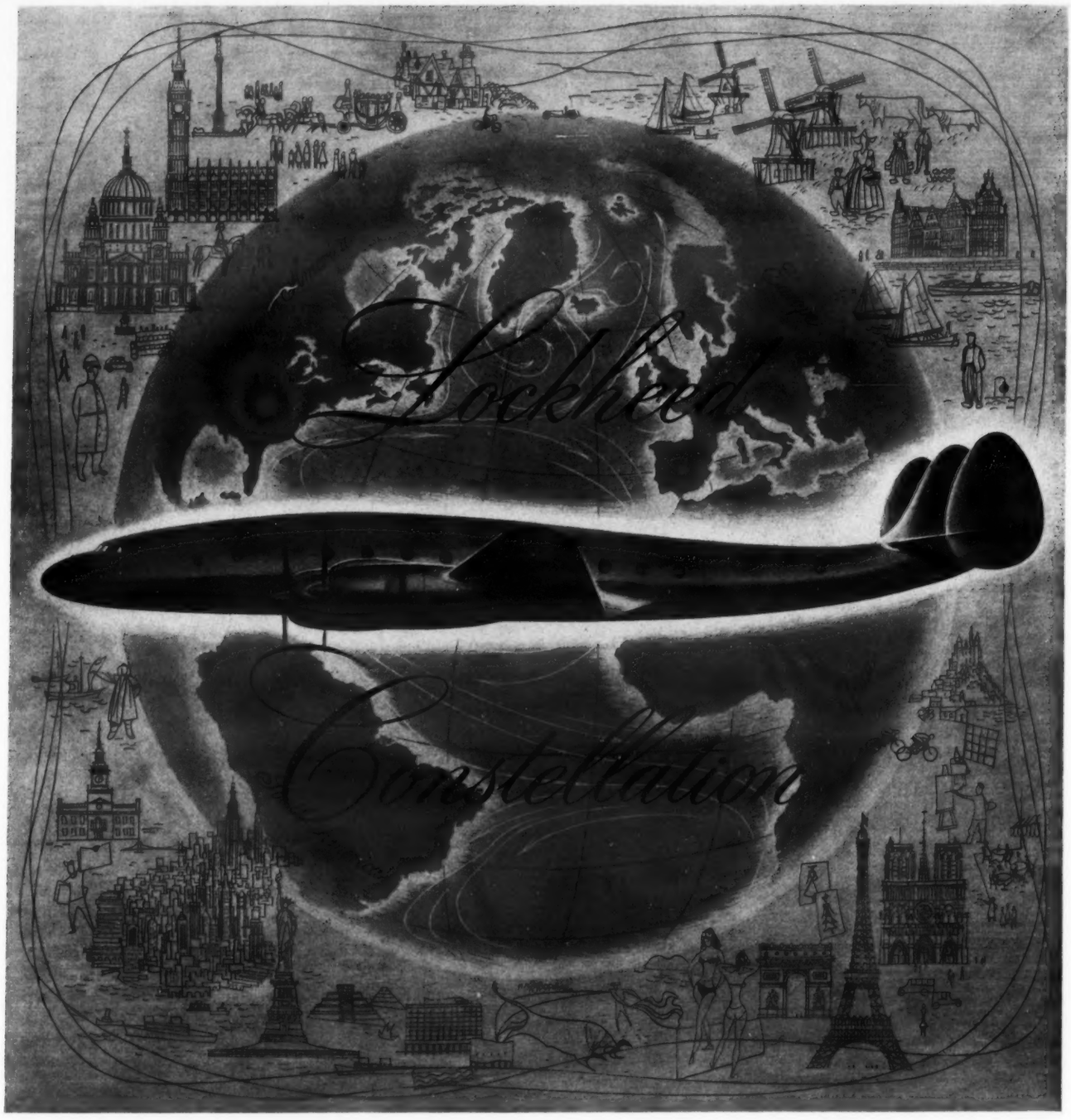
Air Freight Exchanges

The Air-Lift in Pictures — Australian Private Flying

Argentine Civil Aviation — War on Delays

Economic Aspects

VOLUME IV No 1 JANUARY, 1949



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Review of World Aviation

OFFICIAL ORGAN OF THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

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Lockheed P2V "Neptune" long-range reconnaissance aircraft over Alaska.

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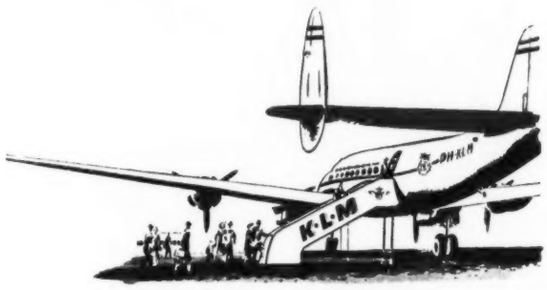
In the air



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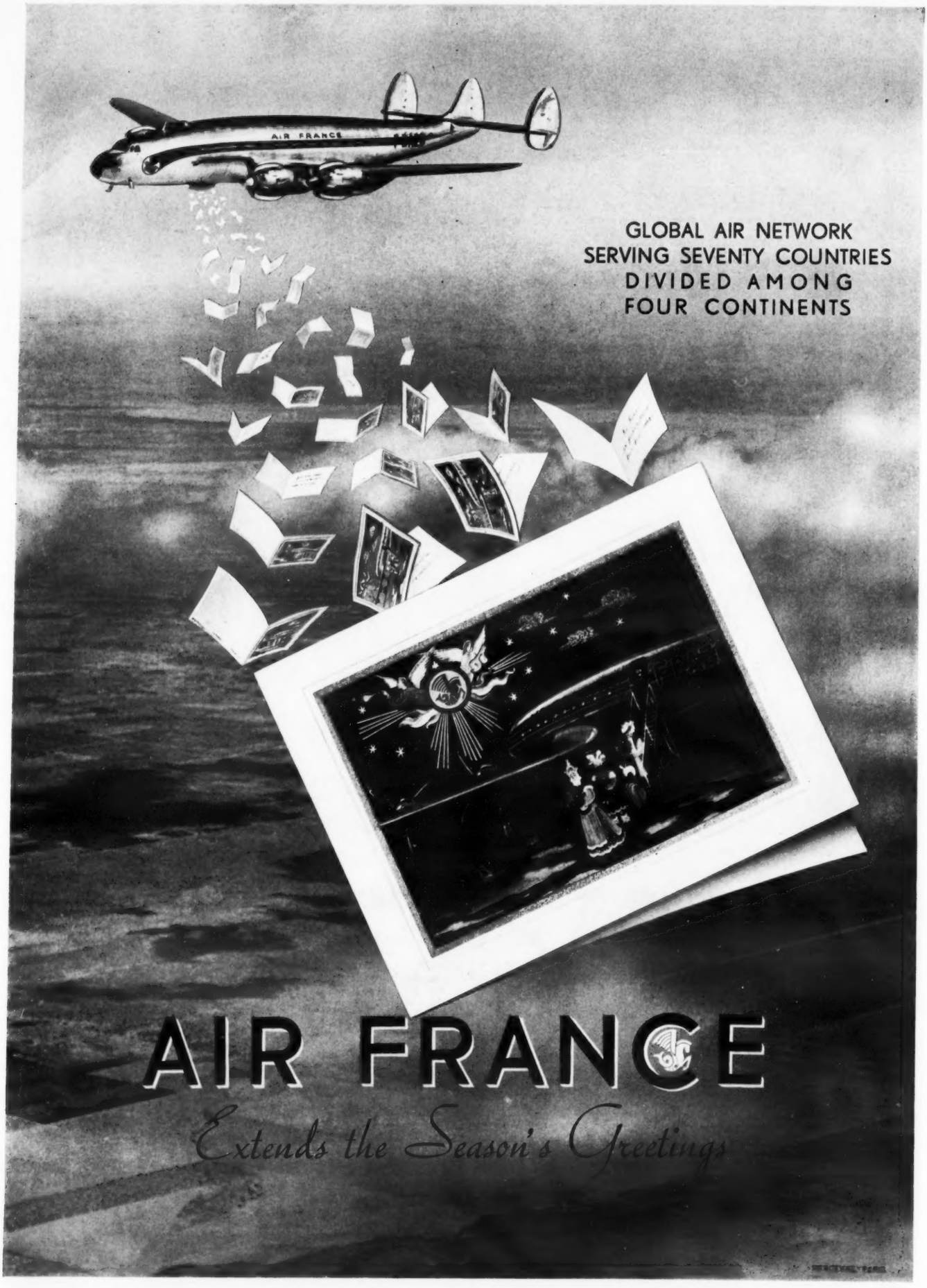
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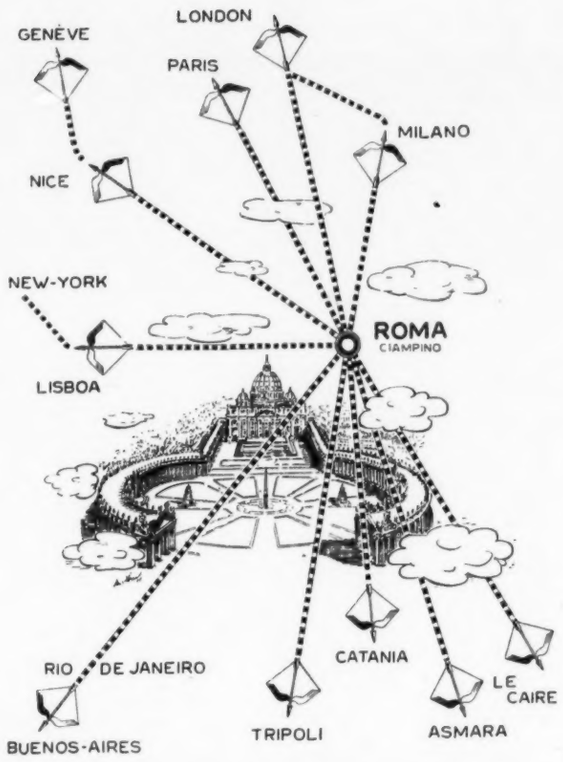

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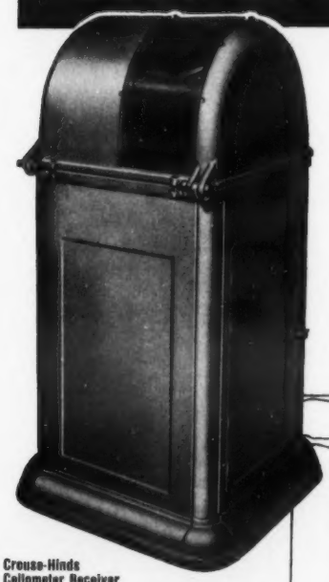

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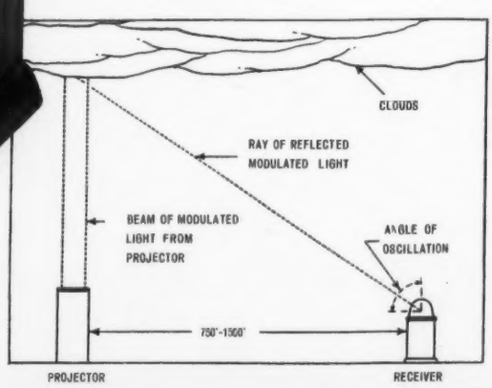

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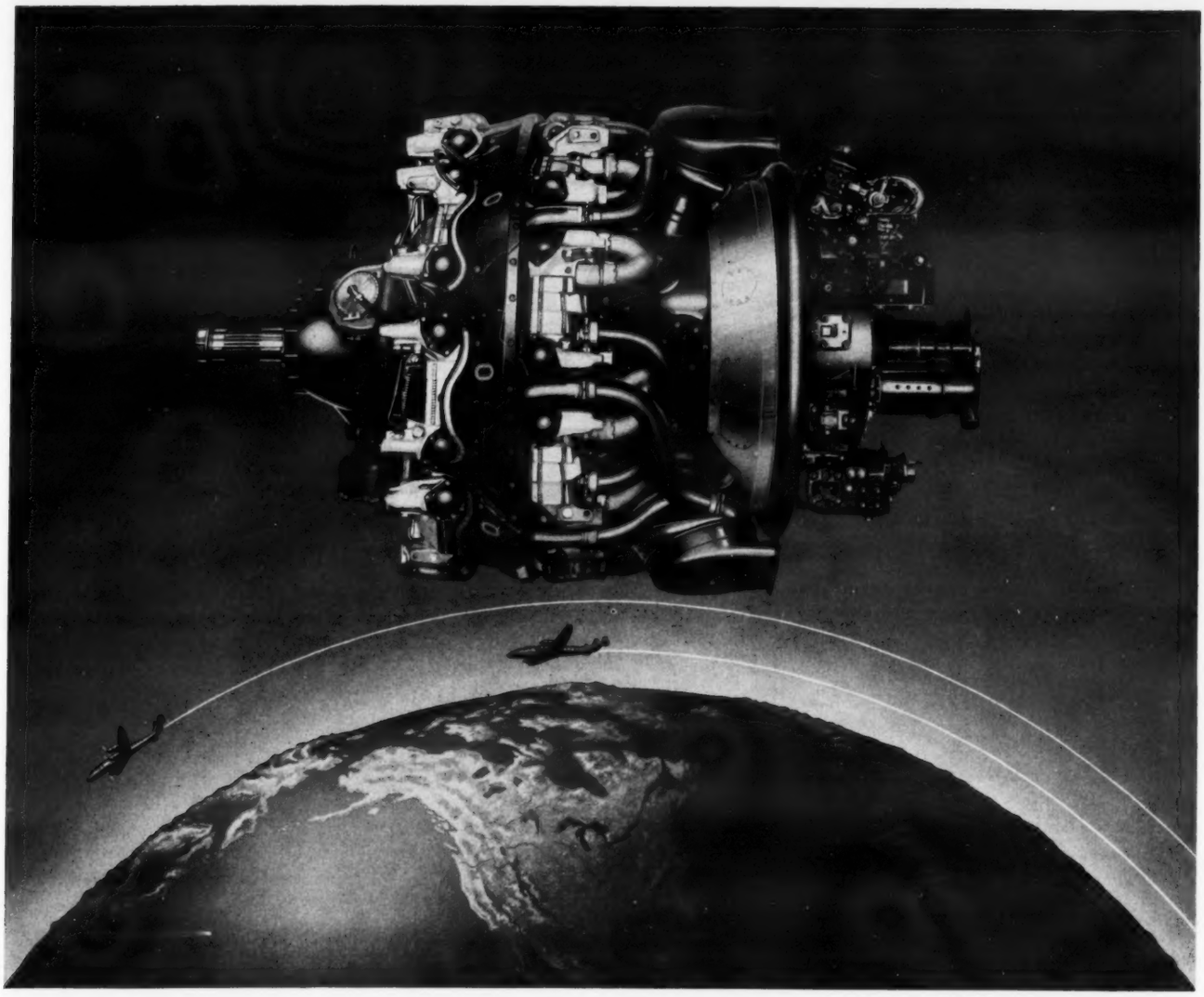

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New Year Thoughts by a Contemporary

4th DECEMBER, 1948

" English politeness : ... very much tact is shown in all classes of society, by young and old. He who flatters is suspected of having kissed the Blarney Stone, in Ireland, which is alleged to confer the gift of persuasive eloquence..."
We have not kissed the Blarney Stone.

New Year festivities.

New Year, 1965...

At London's Savoy Hotel, British Overseas Airways Corporation is celebrating its twenty-fifth anniversary. Its wildest hopes have materialised.

What was that prophetical announcement in 1948 by Whitney Straight, the airline's Chief Executive at the time ? — "No self-respecting American will travel in an American ship. He prefers the 'Queen Elizabeth' or 'Queen Mary.' We want to see the day when no self-respecting American will travel in an American airliner."

Seventeen years later we find seated at the same table all the top-men of international aviation. They are in high spirits. Whitney Straight was right : all the world's airlines are now flying British aircraft.

In the meantime the British nationalised airline corporations have succeeded in swelling their yearly losses to such magnitude that they now swallow up almost half the British national income. Everybody had been quick to realise that the maxims of the year 1948—that civil aviation ought to compete with the railways and ships, that it ought to work on an economic basis—were Utopian. For what should the Government do with so much money ? Aviation had shown itself to be the best means of spreading it around. And Whitney Straight was among the first to prove the soundness of this thesis.

The American aircraft manufacturer, Donald Douglas—since grown into a jovial old man with a white beard—proposes the first toast. In the name of the American aircraft-manufacturing industry he thanks his British colleagues : "Where would we have got to if we had continued endeavouring to build aircraft with pressurised cabins, jet power plants, supersonic speed and suchlike complicated concepts. We would simply have ruined ourselves. Today we have copied British designs, and are building open-cockpit light aircraft for flying the North Atlantic. The public is overwhelmed with enthusiasm..."

The sound commonsense of good old John Bull had again won through.

National anthems or business ?

Let us return to the year 1948 and all its disputes and political tangles. What was the situation then ?

The way indicated by the Chief Executive of B.O.A.C. was followed in earnest.

Immediately spotting what was wrong, the British industry succeeded in replacing the old twin-engined Douglas DC-3s of the Yankees with twin-engined Vickers "Vikings." Unfortunately, however, the value of the latter aircraft had until then been recognised by only few English people, and still not by all the rest of the world.

During the autumn of 1948, an American came to my office, who also sold aircraft, and by chance twin-engined types. For some reason or other he wanted to fly to London that evening. And on that evening British European Airways were supposed to fly a Vickers "Viking" to London. The departure was scheduled for 7 p.m. from Cointrin Airport, Geneva, and the passengers were ready to go aboard at 6 p.m.

My friend said goodbye to his wife and went aboard. The aircraft taxied out to the runway, but I saw no take-off. Instead, I perceived the aircraft taxiing back to the hangar at about 7.30 p.m. It was a minor breakdown in the starboard engine. Well, things like that happened occasionally during the year 1948. The passengers were unloaded.

Donald W. Douglas, President of Douglas Aircraft Co., in the year 1948...

... and Donald W. Douglas "in the year 1965."

English mechanics and the B.E.A. representative were very concerned about the aircraft, though less about the passengers. These were left sitting in the open air ... British discipline. The passengers had arrived at the airport at 6 p.m., and were still on the same spot at 11 p.m. In the meantime the mechanics had been working feverishly on the Bristol "Hercules" engine, which simply refused to work because something was wrong with an oil conduit.

Now the English captain of the Vickers "Viking" understandably wanted to spend the rest of the night at home in London. But the passengers, too, needed to find a bed somewhere. In the end, the passengers won, for towards midnight the engine was really *hors de combat*. In the meantime every hotel room in Geneva had been booked, so that the passengers had to be hauled up the Jura mountains to St. Cergue, about 25 miles distance from Geneva, to spend the night in a winter sports hotel. My American friend said, dolefully : "Pity ... I've always dreamt about making a night landing in an open field with one of those planes."

A way out might have been found by enquiring of the local carrier, Swissair, whether it wanted to fly the trip with a Douglas DC-3. But British pride forbade this. Motto : International co-operation in civil aviation, service to customers, to passengers ...

*

Four-engined airliners : British Avro "York" ; American Lockheed "Constellation."

British and American twin-engined transports : Vickers "Viking" ; Douglas DC-3.

Another memory of the year 1948.

It was on a trip by Air France from Paris to New York. The usual intermediate landing on Newfoundland could not be made, as the Stephenville and Gander airports were closed in by fog. The flight had to be diverted to the small airport at Sydney, Nova Scotia. The morning sun was shining as we landed. A Belgian, a Dutch and an American airliner were already being serviced, or about to be serviced. Ours was the fourth aircraft, and right after us landed a fifth one, a Lockheed "Constellation" belonging to British Overseas Airways.

Apart from the runway, the facilities at Sydney, Nova Scotia, are far from sumptious. This is understandable since they were built during the war. There are a few huts, one of which constitutes the airport restaurant. Fuel has to be brought from a distance of about 15 miles, and servicing is not simple. But everybody took this into account and waited patiently. We all wanted our breakfast, and the airport kitchen personnel, helped by the stewards and stewardesses of the various carriers, did their best to satisfy about 150 tired and hungry passengers.

And then something peculiar happened. The Belgian aircraft, which had landed first, taxied towards the beginning of the runway, and the U.S. one was being serviced. In theory, it was for the Dutch airliner to take off next, followed by the U.S. and French ones. In theory, but not in practice. The British aircraft, bearing the designation G-AHEK, was given priority. Why ? Nova Scotia belongs to Canada, Canada belongs to the British Commonwealth, the British Empire. The British aircraft was on its own territory, the Empire comes first...

One might have argued that, in reality, there was no longer a British Empire. But it was no use arguing.

In any case, there exist certain rules of international courtesy ; certain principles of general order. In my own home I am not in the habit of serving myself before my guests, although my house is my small empire. But perhaps my opinions are old-fashioned...

*

And now a third memory of the year 1948.

One Sunday afternoon a friend took me to the races in Buenos Aires. Never before in my life had I seen so many excited and almost childishly enthusiastic people collected together in one place.

Suddenly my attention was caught by a group whose focal point of interest was a man gesticulating wildly. What was the matter ?

At the race track restaurant somebody had had the misfortune accidentally to spill a cup of coffee over his neighbour's suit. The neighbour became angry, and words ensued. The culprit was hauled off by the police. And now the excited man of whom I spoke above—who struck me as being a genuine *hidalgo* in Western dress—began to curse the police most strongly : An absolute scandal to arrest a man for such a small matter. They would never have arrested him had he not spoken with a foreign accent. Perhaps he was an English, American or German visitor.

Now compare Sydney, Nova Scotia, with Buenos Aires ; compare the words of Whitney Straight with those of my South American *hidalgo*. And you feel with me the difference between an old and a new world. You will realise certain things which cannot continue.

On the one hand an over-cultivated nationalism, Chauvinism by very definition, a provocation of the Americans. At Sydney, Nova Scotia, false pride, unjustified arrogance, an infringement of the most elementary principles of politeness. In South America ? In the case of a quite young nation, which is by no means among the poorest and has no less national pride than any other country, a respectful attitude towards others, a welcome for foreigners, and a true spirit of hospitality.

An evening in New York.

I received an invitation from an American industrialist, a person of some importance who employs about 30,000 workers.

South American skyscrapers : Buenos Aires.

We spoke of many things ; of the world situation as reflected by the UNO negotiations in Paris concerning the Berlin conflict, and of the differences between former allies.

And suddenly my host said, pensively : "After all, what do we Americans care about Russia ? Let us leave the Russians to be happy in their own way, if it pleases them. The main thing is and remains that they should not bother us and we should not bother them. The present conflicting questions probably stem from the rather hastily concluded armistice. These questions must be clarified, worked out, and put on one side. After all, the Russians have certain peculiarities, and we probably have some, too. The Chinese eat their rice with chopsticks, and we eat it with a fork. But such differences are not reasons for war, as long as one does not make them into reasons for war.

"No, something else disturbs me at the present moment. We must first of all solve another problem, the British one..."

I looked at him in astonishment. He was perhaps not a New Englander, but he was certainly one hundred per cent. American. He was not a Zionist either, nor was he a Jew. Otherwise I could have explained his attitude as being connected with the events in Palestine. No, this was not the motive.

His train of thought was roughly as follows :

I have always admired England. Still today I like to deal with the English just as much as I like to deal with the people of any other nation. When England was in trouble during the last war, my sympathies and willingness to help distinctly pointed towards England. I wanted to help to prevent Great Britain from losing the war, and if I had had my say in the matter, there would still be a British Empire.

But we must face the fact that this Empire no longer exists. And the English, too, should gradually begin to understand this. Today there is no longer a British Empire. Luckily there is no Grossdeutsches Reich either ; but neither is there such a thing as an American Empire, nor should there ever be a Russian Empire. What do exist are countries of different sizes ; nations for whose benefit the United Nations Organisation has been created. And if this organisation is to remain alive, then we must begin by sweeping away every Empire concept.

There is no denying that we Americans are at present concerning ourselves with matters which, to tell the truth, are none of our business. We are occupying ourselves with European conditions, and simultaneously incurring for ourselves considerable expense and risk. And why do we do it ? Because, after all, a trace of sentimentality slumbers inside every American. The one has an English great-grandfather, the other a German

mother ; a third has an Italian aunt and a fourth has a sister who is married to a Frenchman. This sort of relationship with Europe perhaps leads indirectly to the Marshall Plan. And, in practice, our aid to Europe became necessary because our people in Washington —in the light of a number of stupidities committed by their predecessors—recognised one thing : We played a decisive part in bringing the last World War to a conclusion. With this, we have taken on certain responsibilities for ourselves and those who will succeed us ; responsibilities which culminate in the desire not to send our boys into a new world war every ten or twenty-five years.

Now this world war has left behind it a pile of ruins, a part of which we created, though contrary to our own wishes. These ruins have to be cleared up. They do not only include ravaged cities, but also the British Empire. And many Britons are holding almost desperately on to their pile of ruins, which they do not want to clear up. Every time we try to clean it up, they hinder us.

If people continue hampering our efforts to clear up, only two possibilities remain open to us. One, which is the most dangerous for us and the others, would be for us to leave the ruins as they are, pack up our bags and go home. Then the next world war would be a certainty. The other, less dangerous but not less unpleasant, would be for us one day to speak with the voice of authority and force the others to work alongside us to create order. Once everything has been cleaned up, there will no longer be a Russian problem, for the Russians, too, would have to adjust themselves to the new world situation. Thus our first job is the British problem . . .

An evening in Buenos Aires.

Through conversation with the Argentines I endeavoured to discover the plans and prospects of Argentine aviation and Argentina as a whole.

The Argentine is terribly proud of his country and its capital, Buenos Aires. But he is well aware of the fact that his country, though richer than some, is not yet fully exploited. To the present fourteen million inhabitants there must probably be added another seventy or eighty million in order to populate these vast regions and bring to light the country's immeasurable natural riches. Knowing that immigrants will ultimately become real Argentines, he welcomes and encourages foreign help.

This also applies to Argentine aviation. In Cordoba, for instance, there is a Government aeronautical works, where Britishers and Americans, Germans and Poles, Italians and Czechs, and occasionally Argentines, too,

The President of the Argentine Republic, General Don Juan Domingo Peron (third from left), and the manager of the State-owned aircraft works "Instituto Aerotecnico Militar de Cordoba," Brigadier Juan I. San Martin (extreme right), accompanied by their wives. Mrs. Peron is on the right of Brigadier San Martin.

work together, and to all appearances are united. The concern purchases foreign licences, copies other designs and endeavours to develop its own.

Rolls-Royce turbo engines are manufactured at Cordoba, and it gives me pleasure to report that, in the local Rolls-Royce representative, Mr. R.V. Longinetto, the British firm has an excellent ambassador. Alongside English engineers are to be found Germans—who were probably once employed by the Focke-Wulff firm—Americans and many others. And this very young and once very small Argentine aircraft industry has already built two jet fighters, which really fly.

Of course, all these developments are of very recent date. At the end of the war the Argentines were in urgent need of help from abroad, and in view of the traditional ties with England, this help came first from the British Isles.

However, if the British sold these relatively innocent South Americans airliners such as the four-engined Avro "Lancastrian" or Avro "York" for good money, and also delivered various twin-engined aircraft, then this perhaps represented immediate business for the British, but not the sort of business which can pay in the long run. For even the Argentines noticed, after some time, what was in the hangar. A number of Argentine executives had to resign their positions, and a number of Britishers will not find it so easy to do further business in Buenos Aires.

As a result, the British aircraft industry is beginning to lose ground in Argentina, and the U.S. industry is beginning to gain ground. The Argentine airlines are now flying Douglas

Argentine I.Ae. 27 "Pulqui" jet fighter.

DC-3s and DC-4s. They will soon be operating Douglas DC-6s and "Convair-Liners." And perhaps the Argentine Air Force will one day fly Lockheed fighter aircraft, in view of the fact that they have not always been entirely happy about their dealings with certain of their English friends.

*

Looking into 1949.

I am neither a prophet nor a politician. I cannot tell you whether 1949 will bring war or peace. I can only hope and believe that it will bring peace.

From the newspapers I observe that, at the recent UNO meetings in Paris, a certain Mr. Bramuglia from Buenos Aires—an Argentine lawyer of whom scarcely a single European or Asiatic had heard a year ago—succeeded in commanding all ears for the simple reason that he endeavoured in a human manner to rid the world of its sources of conflict. Perhaps Mr. Bramuglia could be regarded as an ambassador of all the young nations of the New World, who wish to bring the Old World back to its senses.

As regards aviation, in which we are all interested to some extent, we should not forget that it also needs to recover its health.

And if Mr. Whitney Straight, of British Overseas Airways Corporation, declared openly in 1948 that he hoped soon to see the day when no self-respecting American would travel in an American airliner, but would presumably prefer a British one, then in a way he made himself a laughing stock. He ought to start by cultivating English preference for British airliners, for it cannot yet be said in all truth that the British themselves prefer their own aircraft to American products. The fact that a British commercial transport pushes to one side the airliners of friendly nations as *quantité négligeable*, constitutes an unfriendly act and reveals an element of conceit which must lead to certain conclusions. By boasting that British aircraft are the best in the world, putting them on foreign markets and not always making the customers exactly happy, the British export trade is doing something which it did not do before the war. Before the war its motto was quality, even at the penalty of sacrifices.

All this shows that the year 1949 must absolutely give birth to a turning point in the British export policy, which can no longer sail under the Empire flag. We cannot say whether in a few years time the Americans will really choose to fly exclusively in British airliners or whether the Argentines will buy only British aircraft. All this depends on the attitude which Merrie Olde England ultimately takes towards the other nations of the world. *E.E.H.*

From Coffee House to Air Freight Exchange

The Baltic Coffee House, founded in the eighteenth century, was the origin of today's BALTIC MERCANTILE AND SHIPPING EXCHANGE, in London. The air section, known as the AIR BALTIC, is on the same premises (24, St. Mary Axe).

Clear . . . but could be misunderstood.

French newspapers of October 19th, 1948, carried the following announcement: "The Paris Air Freight Exchange (Bourse de Fret Aérien de Paris—BFAP) today held its first meeting on the premises of the Paris Mercantile Exchange. The new Exchange, which handles air freight contracts and charter parties, has been modelled after the pattern of the Air Baltic, the air section formed a year ago at the Baltic Mercantile and Shipping Exchange, Ltd., in London.

More or less well-informed people will not be very surprised to hear that air freight exchanges are being opened. The transport of goods by air has developed at a meteoric rate since the end of World War II. U.S. aviation circles estimate that the U.S.A. exported by air goods to the value of $300,000,000 during the year 1948. And the planning divisions of a number of airline companies predict that the cargo transport aircraft will play a bigger rôle than the passenger airliner during the next ten years. On the other hand, it is evident that a considerable part of the European air freight capacity has so far remained unused, simply because of the lack of an organisation for systematically assessing and presenting the freight market.

The establishment of air freight exchanges is nothing but a natural reaction. At first glance, therefore, the above announcement seems to be absolutely clear. It is only when one examines it more closely that certain expressions seem to require further explanation. What, exactly, is a charter party? And what is the rôle of the Baltic Mercantile and Shipping Exchange? Does it solely concern itself with handling ships and cargoes destined for the Baltic countries? The name "Baltic Exchange" could arouse this erroneous impression, and it is a fact that the manager of an air freight company, when asked for his opinion on the Air Baltic, answered to the effect that such an exchange would be of no interest to his company since he was not concerned with transporting 'goods to the Baltic countries. This gentleman's answer shows that he was completely ignorant of the real rôle of the Baltic Exchange.

From Coffee House to Air Freight Exchange.

In the history of shipping, all roads lead to England. Why is it that sailors throughout the world today wear black bands around their hats? Because the British Admiralty, upon the death of Nelson, decreed that all English sailors should wear black bands around their hats as a sign of mourning.

Merchant shipping, as it exists today, developed after the discovery of America. England was its cradle. Mediaeval shipping, which developed notably in the Italian ports of Venice, Genoa, Pisa and Amalfi, was run on the basis of co-operative funds. Merchants frequently accompanied their consignments over the oceans. It often happened that they did not only own the freight, but the ship, too. It was only gradually that the various activities came to be divided among exporters and importers, and shipowners. And there arose a formerly unknown appetite for shipping news. Newspapers carrying reports on the arrival and departure of ships, on freight tariffs and foreign exchange rates were not available to the London merchants towards the end of the Seventeenth Century. The official London Gazette, the only reliable source of news, consisted of a single sheet containing strictly censored reports which were only partly concerned with shipping. If

"The floor" at the Baltic Mercantile and Shipping Exchange, Ltd., in London. Aircraft are chartered here.

This is what the former "Kidneys" of the coffee houses look like today: ATTENDANTS AT THE BALTIC MERCANTILE AND SHIPPING EXCHANGE.

"Five tons of shoes from London to Barcelona. I think we can manage that all right."

The first thing that catches our eye at the Paris Air Freight Exchange are the large blackboards on which are chalked the available aircraft and cargoes. Once the two blackboards have been balanced, the day's work is done.

Management of the Paris Air Freight Exchange (left to right) : Jacques de la Brosse (smoking a pipe), Director ; M. Capgras, Treasurer ; Jacques Dervieu, Exchange President ; H. M. Chevallier, Secretary-General.

"... fifteen tons of oranges from Algiers to Paris." Who will take over the consignment ?

merchants, shipowners or sea captains wanted to know the price of indigo, for instance, or if they wished to find out which ships were sailing to Jamaica, or to hear the latest reports on the activities of pirates in the Mediterranean, then they had to hold meetings with their colleagues in order to exchange valuable news orally. True, there existed exchanges at that time. The Royal Exchange was far more the heart of the City than it is today. But the Royal Exchange, as well as the less important Middle Exchange and Exeter Exchange, provided totally inadequate accommodation for such meetings of the mercantile community. And London's taverns at the time of Charles II were rather low dives, the scenes of drunken orgies and excessive gambling, and hardly the place for clear thinking and quiet personal intercourse between merchants.

Thus it came to the institution of the London coffee houses : clean, sober places devoted more to the conclusion of business than to entertainment, which very soon became the special meeting places of individual branches of business. During the 1680's a certain Edward Lloyd founded a coffee house which he transferred in 1691 to Lombard Street, in the vicinity of the General Post Office. His customers laid the foundation stone of the English marine insurance concern which has carried the name Lloyd's around the world. Jonathan's Coffee House, in Exchange Alley, later grew into the Stock Exchange, whereas Hains's, Garraway's and Good's Coffee Houses were chiefly the scenes of ship auctions. (Such sales, incidentally, were an extremely exciting occasion ; a real test of nerves. At the beginning of the auction, known as a "sale by inch of candle," a lighted candle of one inch in length was placed on a barrel, and as long as it remained alight, bids could be made. Pepys writes the following of one of these sales : "... I observed one man cunninger than the rest that was sure to bid the last man, and to carry it ; and inquiring the reason, he told me that just as the flame goes out the smoke descends, which is a thing I never observed before, and by that he do know the instant when to bid last, which is very pretty.")

Upon entering the coffee house, the guest laid a penny on the bar. This entitled him not only to a dish of coffee and, in winter, a share of the fire, but above all to an insight into what was transpiring in the shipping world. As the reports came in, the "Kidney," the serving boy at the coffee house, got into the "auction pulpit" and read them out aloud. (Still today the attendants at the London Stock Exchange are known as "waiters.")

It looks very much as though these coffee-house keepers and waiters also acted as ship-brokers. One of the issues of the year 1681 of the London Gazette advertises that a ship was about to sail for Carolina, and that freight or a passage could be booked in it at the Jamaica Coffee House.

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The year in which the Baltic Coffee House was founded cannot be stated with certainty. A newspaper published in 1744 writes that this coffee house would be removed to Threadneedle Street. Furthermore, it is known that large transactions in wheat, maize and barley

Perishable goods are stored in refrigerators at the airport, pending their transport by air.

Small electric trucks for carrying parcels across the aerodrome.

In two hours time, this consignment of radio sets will leave the Lockheed Air Terminal, at Burbank, California, for New York, on board a C-54 of the Flying Tiger Line. Radio manufacturers prefer to send their products by air.

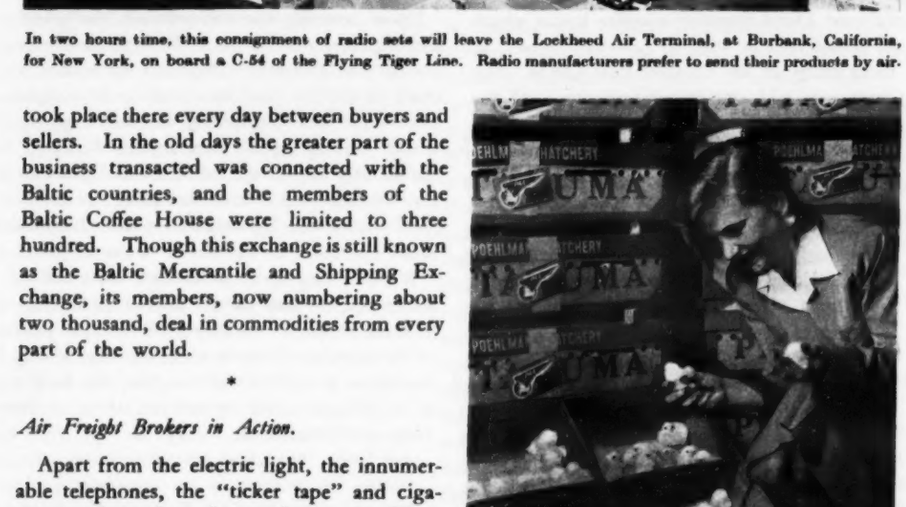
took place there every day between buyers and sellers. In the old days the greater part of the business transacted was connected with the Baltic countries, and the members of the Baltic Coffee House were limited to three hundred. Though this exchange is still known as the Baltic Mercantile and Shipping Exchange, its members, now numbering about two thousand, deal in commodities from every part of the world.

*

Air Freight Brokers in Action.

Apart from the electric light, the innumerable telephones, the "ticker tape" and cigarettes, what takes place today at the Baltic Exchange is not very different from two hundred years ago. Brokers, representing export and import firms, or shipping companies and air freight companies, continue to

Day-old chicks learn to fly . . . with Pan American Airways.



David on wheels and Goliath on wings.

amble across "the floor." A number of charter airline companies and the nationalised British Overseas Airways Corporation are members of the Exchange and do not need to go through the intermediary of a broker.

Over there we see young Mr. McKeen, junior partner of McKeen & Sons, leisurely approaching a soft-spoken, bald-headed gentleman named Mr. Adams. Early this morning McKeen received a telephone call from one of his clients, Miller & Co., shoe manufacturers, who wanted five tons of shoes sent by air to Barcelona as soon as possible.

McKeen's guileless face does not betray the urgency of his mission as he approaches Adams. Judging by his faintly bored expression, he might for all the world be any well-bred young man attending a family gathering. He begins by giving Adams a chance to talk about grouse shooting. Grouse shooting is known to be Adams' weakness ; and quite aside from this : the air freight carrier he represents, wants £1,200 for a return trip to Barcelona.

Miller & Co., the shoe manufacturers, only want to pay £850 for the one-way trip.' Mr. McKeen has to drop the conversation about grouse hunting. This he does very politely, and approaches a broker who represents an importer of tangerines. It is not long before he has negotiated a fragrant cargo for the return trip, which will make up the remaining £350. Mr. McKeen has done his business for the morning. He sits at the pleasant bar of the Baltic Exchange with Mr. Adams ; they smoke cigarettes and, as their forefathers did two hundred years ago, drink a cup of coffee.

Did you by chance notice anything peculiar about the manner in which this charter party was negotiated ? There was no exchange of documents, and nothing was signed. The whole business was done by word of mouth. Once they have returned from the Baltic Exchange to their respective offices, these brokers book and confirm the contracts.

Really awe-inspring contracts are negotiated day by day in connection with wheat, maize and other cereals. Tramp steamers—and also tramp aircraft during the past year—are chartered for trips to every corner of the globe. And although such contracts are not binding in law, it is extremely seldom that differences arise. These contracts are strictly enforced by the Exchange, and chartering agents as well as owners' brokers (of air freight companies) know that a broken contract, unless there is a good reason, would result in their expulsion from the Exchange.

To speak of air freight brokers is all the same a little premature. Of the sixty-nine member firms on the roster of the Air Baltic, only very few are solely concerned with the air freight business. The majority is chiefly concerned with shipping. Aircraft owners' brokers, that is to say brokers who exclusively represent air freight carriers, do not yet exist. And despite this, the turnover at the Air

Baltic is considerable. Though rates and cargoes are not marked up on a board (in order to prevent rate cutting), and the Exchange consequently keeps no record of the amount of business transacted, a well-informed broker of one of the leading companies estimates that about ten to fifteen million ton-miles have been flown during the last six months on contracts negotiated through the Air Baltic.

*

Upon entering the Paris Air Freight Exchange it immediately strikes us that a much more official tone reigns than in London. Offers and rates are chalked up on large blackboards ; there exist rules and regulations which involve simple warnings, strict warnings, and fines ranging from 1,000 to 50,000 francs ; temporary and permanent expulsion from the Exchange. Moreover, all brokers admitted to the Paris Exchange jointly pledge to fulfil every individual contract. They all pay fees into a guarantee fund, which is administered by the Air Brokers' Association (Syndicat National des Courtiers Agréés près de la BFAP).

French stock exchanges have always worked under State supervision. Whereas shipping brokerage in Great Britain grew up as a free profession (this is also the case for Argentina, Belgium, Germany, Norway), French brokers have always been sworn in and endowed with State-ruled privileges and duties (for example, they have to keep a special register, etc.), which were introduced in order to protect the public interests. And this historical development is reflected in the organisation of the youngest branch of French freight brokerage.

Contrary to B.O.A.C., Air France, likewise the national airline company, is not a member of the Air Freight Exchange. And the most essential difference : the Paris BAFP is used for negotiating air freight contracts and charter parties, whereas only charter parties are negotiated through the Air Baltic. What exactly is a charter party ?

The "carta partita."

We read of charter contracts and charter parties ; we hear of charter companies and we charter aircraft. However, few people know the exact meaning of the word, and therefore frequently use it in the wrong sense. Its origin traces back to ancient times. The Latin "carta partita"—the divided document —was a document which had been cut across in zigzag. Anybody who wanted to prove his rights thereby, had to show that the edge of his section matched exactly the edge of the section in the possession of the other party.

In a charter party in merchant shipping, the shipowner leases his ship or part of his ship's hold, and simultaneously pledges himself to transport the goods to the port of destination

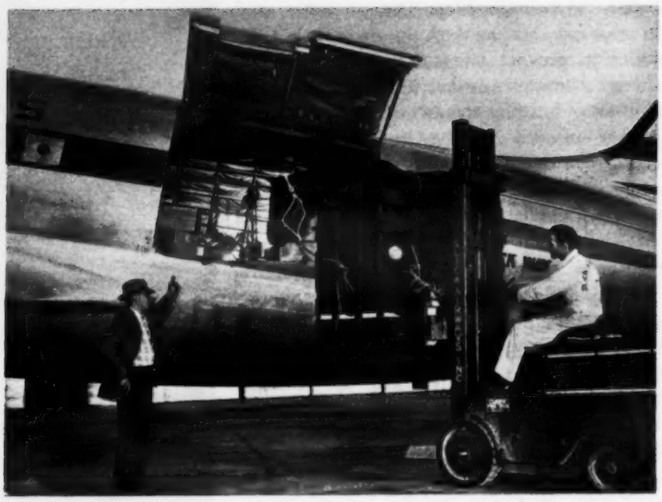
Nothing is too heavy. A three-ton tractor about to be flown to the U.S.A.

Concerts can be given at any place in the world nowadays. Slick Airways, Inc., load up a piano.

Fresh eggs being loaded overnight in order to keep them fresh.

All model dresses ... though by coincidence all the same model.

One fellow who does not have to show his passport.



Upholstered airborne stables for racehorses.

stated by the sender. The freight contract has nothing to do with the leasing of space on board a ship or an aircraft. The shipowner pledges himself only to transport the goods (in shipping, persons come in the same legal category as goods).

As far as shipping is concerned, the charter party lost much of its former significance when steamships made their appearance. The big scheduled lines refused to be governed by the conditions formulated by the owners of the consignments. Preferring to handle the goods in lots, they submitted their tariffs and business conditions to the merchants, and gradually seized a monopoly in the field, which even subsequent major economic crises have not been able to rupture.

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This brings us to certain problematic aspects of the air freight exchange business.. In certain circumstances, it can lead to unhealthy speculation.

It sometimes happened that merchants chartered sailboats with no intention of loading them and sending them on their way. They often wished merely to gain by the increase in freight rates, and therefore reserved the right to sub-charter the ship's hold, and had the ship sail at a suitable time with somebody else's goods on board.

A merchant could also speculate on a drop in freight rates, with the result that he would first negotiate contracts with the owners of the merchandise, and then charter the ship once the freight rates had sunk sufficiently low.

The final result was a business deal which had nothing in common with shipping, but was simply a sort of bet between the shipowner and the speculator. The shipowner had to pay the speculator if the rates dropped, and vice versa. In such transactions, it was more often than not that the slower-witted and financially less strong shipowner got a raw deal.

Meanwhile, we have no intention of pouring boiling oil on the Exchanges. There is no doubt that they can contribute greatly towards the development of the air freight business. We are also convinced that the forms of contract drawn up nowadays by the Air Baltic and the Paris Air Freight Exchange exclude all opportunites for unhealthy speculation. And it would be better for aviation if speculators held their distance.

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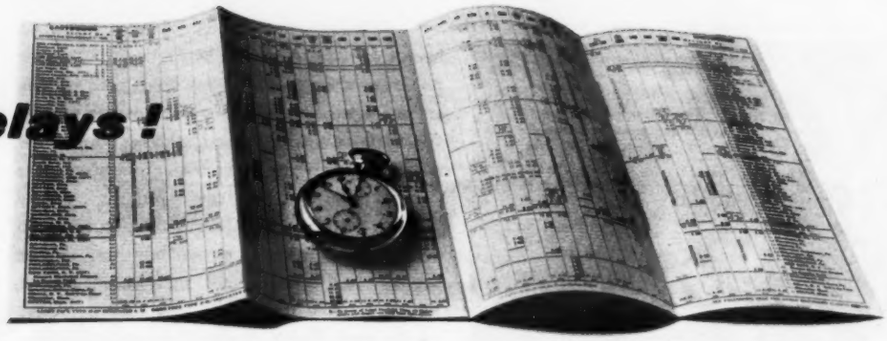
The establishment of air freight exchanges is at present under discussion in Belgium and Holland. It is also said that Italian air freight operators have endeavoured to obtain admission to the London Air Baltic. U.S. operators, however, are not attracted by the idea of the air freight exchange. The American development aims towards a monopoly in scheduled civil air transport, the representatives of which conclude the same types of contract as the big steamship companies and compel the merchant to accept their conditions.

What benefits can the public expect to derive from air freight exchanges ? To put it briefly, a more effective, rapid and therefore economic working of the air freight service ; faster delivery of consignments, less formalities, and lower tariffs. At the present time, it is not possible to predict whether the exchanges will be successful in this direction. But a closer examination of the desires of the sender of consignments could do no harm, for after all it is he who will probably play the main part in the air freight game. *He.*

One of the most delicate of air freight commodities are fresh, ripe figs. First of all, they may not be shaken about too much. Then the pilot has to avoid regions featuring large differences in temperature.

The loading of an aircraft has to be supervised by experienced men.

War on Delays !



Before the war, the punctuality revealed by the railways could, in many respects, be used as a yardstick to assess the political and economic conditions reigning in a country. In the meantime, we have often learned that even in a country where the trains arrive and leave on time, a lot can be rotten ; and from such observations, which the most superficially-minded of travellers is able to make, we no longer draw any profound conclusions. But let us not empty the baby out with the bath ! Punctuality is not only the prerogative of kings and the propaganda of dictators ; it is first of all nothing less than the characteristic sign of a well-organised commercial transport undertaking.

How does civil aviation stand up to all this ? Neither the official statistics nor the releases of the public relations officers devote much space to punctuality. Quite rightly, the primary interest is in the safety offered to airline passengers. And after this comes the money side : traffic volume, revenues and expenses assume greater importance than the time and patience of the passengers.

Meanwhile, both safety and economy in civil aviation can only be improved at the penalty of time-consuming work behind the scenes. Any success achieved is not directly discernible to the general public. It can take years before a new warning device has been tested and introduced as a really effective safeguard against accidents ; or until a new aircraft type, more rational maintenance facilities or a trimming of redundant administrative procedures can enable airline fares to be decreased and dividends to be increased. Precisely today, with many airline companies modernising their operations in every respect on the basis of early post-war experience, much of the progress made is hardly recognisable to those outside the field. Just about the only attractions which a new airliner has to offer, as far as the wider sections of the public are concerned, are the greater comfort and higher speed.

Without in any way relaxing their efforts to improve the safety and economic aspects, a number of airline companies have for the past few months been devoting increased attention to punctuality. Improvement in this domain is a procedure in which every step towards the final goal constitutes a direct benefit to the passenger. And because this goal perhaps tended to disappear from sight during the stormy development period following the war, it offers a chance to achieve real progress. Thus the motto is : War on Delays !

The first progress made by the scheduled airlines towards regularity of service and on-time operation was outlined recently by Milton W. Arnold, vice-president of the Air Transport Association of America, before the New York press. In his opinion, scheduled airline delays and cancellations are caused by three basic factors : weather below acceptable operation limits, air traffic congestion, ground and airport delays.

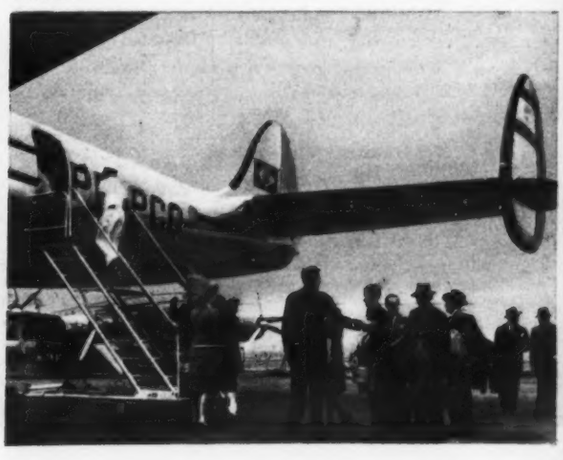
In order to beat the delays and cancellations caused by bad weather at airports of arrival, the first thing to do is to install adequate landing aids. The Instrument Landing System has already proved to be of great usefulness in this respect. There are 79 airports in the United States now equipped and served by ILS, and 66 more airports are to be fitted out as rapidly as ILS can be installed and tested for accuracy. Whereas the lowest limits acceptable for scheduled airline operation were previously set at 400 feet of ceiling and one mile of visibility, ILS has cut these limits by half, allowing landings to be made with a ceiling of 200 feet and visibility of half a mile. Over 50 per cent. of all weather below 400 feet of ceiling and one mile of visibility occurs in this 200- to 400-foot level ; so it is reasonable to conclude that ILS will, this winter, eliminate over 50 per cent. of airline cancellations caused by weather below previously-accepted limits. Perfect all-weather operations, with landings in the absence of all visibility, will have to wait until the systems and devices now being tested, have revealed themselves as absolutely reliable.

Congestion at and around airports during bad-visibility weather is another major cause of delays, since none of the many aircraft arriving at short intervals can be given permission to land before the preceding aircraft has rolled away from the runway. In this connection, especially bad conditions existed a couple of years ago at La Guardia Field, New York, the busiest airport in the world. During the three months from December, 1946, to February, 1947, solely because of air traffic congestion, only 13 per cent. of all scheduled aircraft landed with no traffic delay—in other words, seven out of every eight airline flights were either delayed or cancelled. This state of affairs was, of course, intolerable.

But precisely at La Guardia Field, a great deal of progress was made during 1947. A whole series of complementary measures have

THE WAITING ROOM—in railway travel an almost antediluvian concept, but an urgent necessity in airline travel.

ALL ABOARD !—Punctual take-offs make for punctual arrivals.



AIR TRAFFIC CONTROL at Washington National Airport. A careful check is kept on all flights in order that the airport controllers may know what to anticipate in the way of landings.

enabled operations to be carried out more smoothly.

First of all, ILS was installed. Then it was arranged that each aircraft obtaining an order to leave the holding pattern and land, should receive the gateway marker signal via a given shortest path and at a pre-determined time. For this purpose, the "feeding" stack, complete with radio aids, was moved in closer to the airport, the holding pattern more accurately defined, and a specially-developed automatic calculator, which indicates the course to be flown and the time the pilot should return to the gateway marker, installed in the airport control tower. Next, GCA radar was installed, which "pin-points" the exact position of the aircraft and indicates to the controller whether a departing aircraft may be cleared for take-off. Conversion to the new, static-free VHF (very high frequency) radio channels has enabled tower control to be extended to a radius of 50 miles. Control over approaching and landing aircraft in this area is entrusted to two officials who work hand in hand. Finally, inbound and outbound aircraft are made to travel on two separate routes, each route operating entirely independently of the other.

It was found that these measures increased the capacity at the airport by 300 per cent. However, the highest-capacity equipment and organisation of airport operations cannot be completely successful if carriers establish their timetables haphazardly. In the present case, it happened that sometimes as many as twelve flights were scheduled to depart at the same minute of the same hour. As a result, the airlines joined together to level off these peak periods of activity, and scheduled their flights so that no more than two flights were slated to leave during any five-minute period.

An analysis of the three winter months from December, 1947, to February, 1948, revealed that the new measures had not been in vain. Not one single airline flight had to be cancelled because of air traffic delays, whereas there had been 3,877 of these a year beforehand. Whereas no fewer than 4,582 flights were held up for an average of 33 minutes per aircraft during the 1946-47 winter period, only 555 flights of all flights operating in inclement weather were delayed during the corresponding period during 1947-48, and the average delay to these 555 flights was eleven minutes. These are 21 per cent. of all instrument flights, which actually represents only four per cent. of the total flights operated during the three-month period.

It goes without saying that if the problem can be licked at La Guardia Field, it can be licked at any place in the world. And if punctual take-offs can be made at the U.S. civil aviation metropolis, then it means that much has been gained towards keeping operations to schedule at all the airports along routes emanating from New York.

A third major cause of delays are ground and airport delays, involving procedures such as cargo handling, passenger handling, etc. Generally speaking, this is strictly an airline problem. The U.S. airlines went into action. According to Arnold, during the first nine months of 1948 there were 42 per cent. less delays in general servicing procedures, 52 per cent. less in cargo handling and 54 per cent. less in passenger handling.

To sum matters up, on-time performance, or the number of times that the flight arrives at the loading ramp at or before the scheduled time of arrival, increased on an industry average by 65 per cent. in U.S. domestic airline operations. And Arnold closes with the cautious prophecy that, for the first time in airline history, U.S. operators feel confident that they will complete a winter season of operation without major schedule interruptions.

GCA RADAR enables the tower controller at La Guardia Field to "pin-point" the exact position of all aircraft within a 30-mile radius. Not only can he instruct pilots on how to keep to the glide path during blind landings, but he can organise departures and landings in close sequence and with sufficient safety.

Absolute punctuality, however, is still a far-distant goal, even as far as U.S. civil aviation is concerned. The complete figures on which Milton Arnold's happy observations are based, are not available to us. But we know from another source that in June, 1947, 89 per cent. of the aircraft of one of the most reputed airline companies in the U.S.A. arrived late at New York. Let us not generalise—we have seen how unfavourable the conditions used to be at La Guardia field ; but if the punctuality at this airport has only been improved by 65 per cent.—as it has been on the average throughout U.S. domestic airline operations—then 82 per cent. of the landings would still be late. Meanwhile, a company like United Air Lines could only fly 94 per cent. of its scheduled route mileage during the first nine months of 1947, but 97 per cent. during the corresponding period of 1948 ; as far as punctuality is concerned, the company merely mentions that only 6 per cent. of departures were subjected to delays of more than 15 minutes. In this three per cent. improvement from 94 to 97 per cent. there is perhaps greater progress indicated than in the 65 per cent. mentioned above . . . Statistics are not always according to Cocker !

Be as it may, every increase in airline punctuality is a necessary step forwards. Its control by the statisticians of civil aviation authorities, organisations and companies is indispensible, but in reality, it concerns more than the few figures worked out at the end of every so many weeks or months of operations. More important is that one should be able to depend on the timetables, and that everybody can include, as a fixed value in his more general plans, everything that has to do with civil aviation. The group of people to whom the punctual arrival of an aircraft means something, includes far more than those few who are on board. One only needs to consider the many people standing around an airport when an aircraft is not on time : ground crews, office personnel, police, Customs and bank officials ; friends and relatives of the passengers on board ; bus, taxi and automobile chauffeurs. And then there are the employers who have to pay wages—often at an increased rate—to all these people doing nothing. Last but not least, there are wives and domestic servants who have to keep the dinner warm. How often it happens today that all these people—especially at intermediate landing facilities along the major trunk routes, where delays of several hours and even days frequently occur—are condemned to a kind of Bohemian life. To allow these "citizens of Bohemia" to live ordered lives would signify, in reverse, to gain sedentary citizens for civil aviation. *T.*

Berlin-Tempelhof. Not only the technical wonder of the giant aircraft attracts the Berlin children who surround the airport in order to wave to the aircraft of "Operation Vittles." A large part of the food on board is for them.

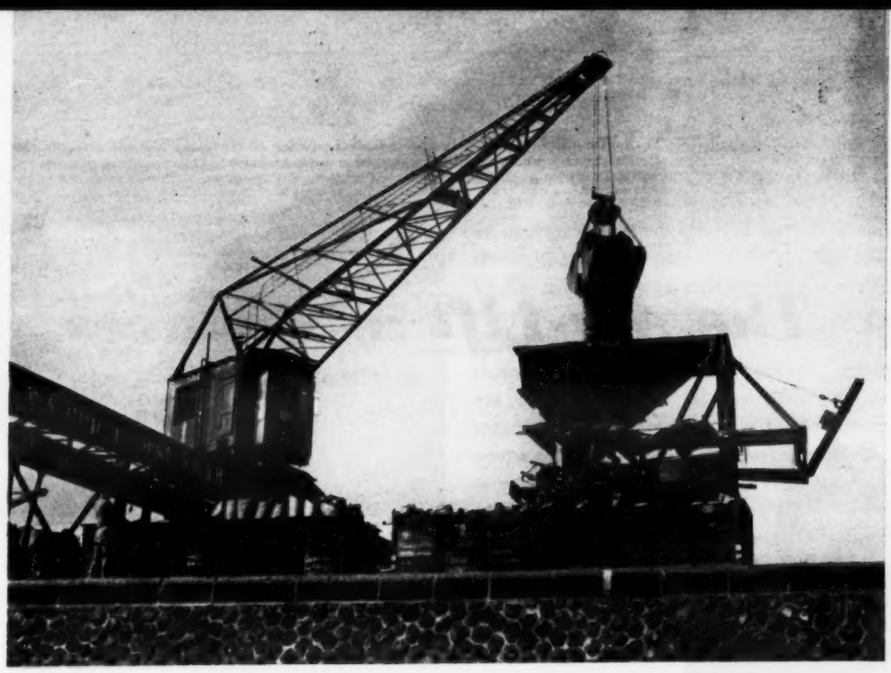
The Air-Lift in Pictures

American and British aircraft have to fly 2,900 tons every day into beseiged Berlin in order to keep alive the population of the three western sectors of occupation. Despite the U.S. name, "Operation Vittles," and the British phrase, "Operations Plane Fare," the commodities transported do not only consist of foodstuffs ; the list embraces everything a human being needs for his existence, from coal to pharmeutical products. The 1,300 tons of flour, meat, potatoes, and so forth, together with the 1,600 tons of coal are, however, sufficient for the German population only. The Allied occupational troops, civilian and military administrative personnel in the Berlin area require another 1,500 tons daily.

To transport by air 4,400 tons regularly every twenty-four hours is no child's play. Right now the beseiged population can thank its lucky stars that a few weeks of good flying weather during summer, 1948, enabled the 5,000-ton level to be exceeded. Whilst it was formerly possible for the Allied transport aircraft to land on Berlin's airport at intervals of only three minutes, this frequency suffered considerably during the unfavourable flying period between autumn and winter. During the first half of November, the ground mist was sometimes so thick that even the most reliable of modern blind-landing devices were of no avail, and operations had to be stopped completely. This was sufficient to disturb the balance between supply and requirement ; for during the first half of November not even the minimum of 2,900 tons a day could be attained. It is fortunate that, according to

It takes more than aircraft alone ! Until the sacks of wheat from the American flour mills have reached the airports of Frankfurt or Wunsdorf, hundreds of transportation vehicles become silent parts of "Operations Vittles." Now and again the Russian authorities allow a few barges to enter the besieged city, but . . .

. . . the goods mostly have to go by the much more complicated way of the railroad up to airport vicinity, from there by ten-ton trucks of the U.S. Army up to the airport. Without the proven rolling stock of the last war, it would hardly be possible to organise smooth supply operations.



Coal is almost the only product which Germany herself can supply in order to help her ex-capital. A part of the Ruhr output is put into sacks on the spot and transported by rail and road to the airports.

Not a minute must be lost after an aircraft has arrived back from its last flight into Berlin. Not only coal and foodstuffs, but also pharmaceutical products pass through the hands of co-operative men and women from all parts of Germany, to whom "Operation Vittles" is a welcome source of daily bread.

Lubricating oils, fuels, spare parts for aircraft engines, and trucks are just as important as the sacks of wheat, for not a single cog of the great air-lift machine must ever come to a standstill.

weather statistics, the ground mist will disappear as the temperature drops. The colder the weather in the ex-capital, the more coal can be carried in !

A big disappointment was suffered by the organisers of the air-lift owing to the insufficient size of Tempelhof airport. Despite the far-sightedness revealed by the planners of German civil aviation in many other respects, Berlin's main airport decidedly reveals a lack of forethought. Surrounded on every side by buildings, its runways cannot be lengthened by another yard. A number of high buildings and factory chimneys in the approach area are now the American pilots' nightmare. Besides this, it was soon learned that although the U.S. flying equipment—chiefly four-engined C-54s —was superior to that of the British, the British air bases were nevertheless far better situated. From Wiesbaden and Frankfurt, whose airports were initially at the disposal of the U.S. Air Force, the flight to Berlin and back requires on the average 313 minutes. At best, therefore, a C-54 could accomplish three and a half flights a day, carrying about 32 tons of freight. From Fassberg, the British airport for flying to Berlin, a C-54 can fly to the ex-capital and back in about 145 minutes, which means that it can execute about five flights daily and transport over 50 tons.

This clearly reveals the advantages of close co-operation between the Royal Air Force and the U.S. Air Force, in view of which a common command post, known as *Combined Air Lift Task Force* (C.A.L.T.F.), has been set up. During the war, the name "Task Force" was given to a military unit which was organised temporarily and assigned an independent combat mission. Such units were frequently composed of a number of aircraft carriers and a very strong escort formation. Happily, the Combined Air Lift Task Force consists—at least at the time of writing—only of transport aircraft. Major-General William H. Tunner, of the U.S.A.F., is Commander of C.A.L.T.F., and Air Commodore J.W.F. Merer, of the R.A.F., is Deputy Commander.

In view of the increased operation of four-engined Douglas C-54 "Skymasters," which have replaced many of the less suitable "Dakotas," "Vikings," etc., and have been transferred to R.A.F. bases in the British Zone of Occupation, it appeared on the surface as though Britain's contribution to the air-lift had dropped somewhat into the background. However, it is certainly very much thanks to the public relations departments of the U.S.A.F. if many people today regard the Berlin air-lift as a purely American undertaking. In order to appreciate correctly the British contribution and the modesty of R.A.F. information organs, it may be noted

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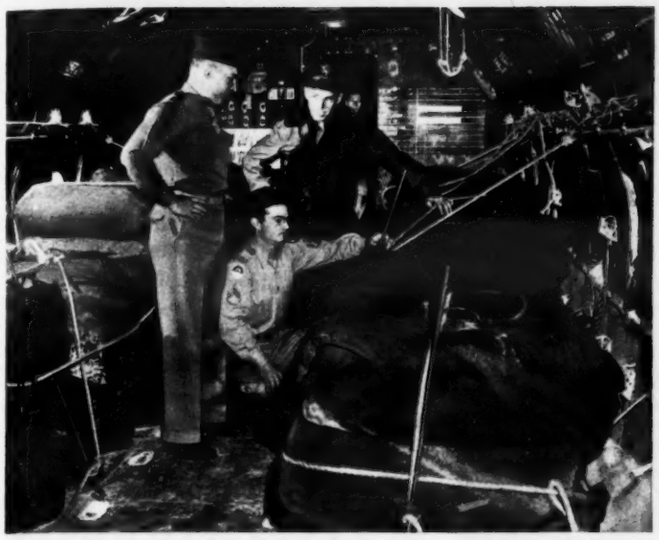


Air-lift pilots have long become used to taking off with considerably overloaded aircraft. Ten tons of coal are carried on every C-54 flight. The storage space is more than adequate, and pilots like to supervise personally the correct stowage of the individual sacks.

The beginning of the unfavourable season gave rise to a lot of work in order to harden the softened ground. Perforated steel plates, which were put into large-scale use during the war, come in very handy. The cargo of this C-47 is destined for Berlin-Tempelhof, where a second runway has to be laid down in view of the need for increased operations.

that, at the beginning of the joint activity (July 15th, 1948) the R.A.F. was transporting 37½ per cent. of the daily freight quota. For the reasons stated above, this share has since (November 15th) sunk to thirteen per cent. Meanwhile, it should not be forgotten that the majority of the airports now in use, are situated in the British Zone, with a result that the R.A.F. is doing about 80 per cent. of the ground servicing work.

The third airport in the western part of Berlin, Tegel in the French sector, was opened at the beginning of November and was able to relieve considerably Tempelhof in the U.S. sector and Gatow in the British sector. Tegel possesses a completely free approach area and is therefore expected to render valuable services, notably during inclement weather. It is expected to be able to cope with about 200 aircraft a day. The inauguration on November 5th, 1948, was marked by the arrival of a C-54 carrying Major-General Tunner and Lieutenant-General John K. Cannon, Commanding General of the U.S. Air Forces in Europe, together with a one-ton load of cheese.

The distribution of the C.A.L.T.F. flying equipment, all aircraft of which fly into the three Berlin airports mentioned above, presents the following rough picture: Douglas C-47 "Dakotas" at Lübeck and Fuhlsbüttel; Vickers "Vikings" at Fuhlsbüttel; Bristol "Freighters" Avro "Lancastrians," Avro "Yorks," Avro "Tudors" I, II and V, Convair B-24s, Handley Page "Haltons," etc. at Wunsdorf; Douglas C-54 "Skymasters" at Wiesbaden, Frankfurt, Fassberg and Celle (22 miles northwest of Hanover); and Handley Page "Hastings" at Schleswig-Land, one of the largest airports in Northern Germany, situated about 25 miles northwest of Kiel, with two runways of 5,900 ft. and 7,880 ft. in length.

Night shift! Work continues relentlessly. Whilst a fuel truck is pouring gasoline into the aircraft's wing tanks, an Army truck is bringing new cargo for loading into the fuselage.

Not a minute must be lost! In the glare of searchlights U.S. mechanics check every detail of their aircraft. It is not merely a case of preventing technical accidents: breakdowns or undercarriage failure on the runway could bring the entire supply operation to a standstill.

The "notice board" at Rhein-Main airport, Frankfurt, is viewed with interest and pride by crews and ground personnel. Each day the performance of the last twenty-four hours is recorded. At the time this photo was taken, the largest transport aircraft of the U.S. Air Force, the Douglas C-74 "Globemaster," had contributed its share with six flights, each time carrying almost twenty tons of freight.

Whereas the above-listed aircraft types keep strictly to the two approach paths into Berlin and may only fly out through the western central corridor, the flying-boats based at Hamburg-Finkenwerder use the northern air route on both outbound and inbound trips. The River Havel serves as a marine base in Berlin, though flying-boats are only operated under good visibility conditions and fly much lower than any of the landplanes used in the air-lift.

The Berlin air-lift, which has uninterruptedly proved since June 28th, 1948, that the Western Allies have no intention of relinquishing their position in Germany, is not only of political importance. From the standpoint of modern national defence, air transportation is playing an increasingly significant rôle. It is just as important to have well-trained transport pilots as it is to have ace fighter pilots. Is it possible to imagine a better training ground than the Berlin air-lift, which has to remain in function under all weather conditions, and compels pilots to submit themselves to strict discipline when flying in this exceptionally dense traffic net-

Brigadier-General Joseph Smith was Commandant of the Wiesbaden military post before he was chosen to organise "Operation Vittles." He is known to be an excellent organiser and qualifies as the most impatient and the gruffest U.S. officer in Germany. Anybody looking for a soft spot during work hours keeps a wary eye on General Smith.

On October 15th, 1948, Lieutenant-General John K. Cannon (left) resumed the post of Commanding General of U.S. Air Forces in Europe, which he held in May, 1945.

Major-General W. H. Tunner (right), Commander of the Combined Air Lift Task Force, is an air transport specialist. During the war he was responsible for air transport operations in the Far East in connection with the Chinese Allies.

The French sector of Berlin also has its airport. The six-thousand-foot runway at Tegel was laid down in an exceptionally short time by the German population.

Schleswig-Land was one of the main Luftwaffe night-fighter bases during the war. Located near Kiel, this relatively well-constructed airport was repaired after the war and is now used as a base for the R.A.F.'s latest transport aircraft, Handley Page "Hastings." Able to cope with an eight-ton payload, these aircraft closely approach the C-54s and are envisaged as a replacement for the four-engined Avro "York" and Handley Page "Halifax" transports.

work ? Also for civil aviation, which throughout the world today is suffering from congestion at airports, the experience gained around Berlin will be valuable. If at other airports in the world operators succeeded in even approaching the landing frequency achieved at Berlin every day, then much would be gained.

During the last years of the war the world became used to regarding the joint operation of a thousand or more aircraft as perfectly natural. And today ? Scarcely three and a half years since the cessation of hostilities, the greatest air powers in the world admit that is it a difficult job to assemble an air transport fleet capable of carrying 5,000 tons of freight daily to a city located only a few hundred miles from their bases. Perhaps these considerations will not remain without influence on the structural programmes of coming years — quite apart from the fact that the aircraft now in operation cannot continue to fulfil their task for ever. The almost exclusive utilisation of GCA (Ground Controlled Approach) radar landing aids proves that valuable ground personnel for air forces and airline companies can be trained. Here, too, experience is everything.

It is not a case of the air-lift beginning in Wiesbaden, Fassberg or Wunsdorf, and ending in Berlin. It begins on American wheatfields, in Argentine meat storage centres, Danish dairies and Ruhr coalmines. Transportation up to the airports of departure is not the worry of the air forces, but of the supply organisations of the Occupational Powers.

Apart from the Spandau Gaol, towards the end of the year there remained only a single official bureau in which there lingered some effective vestiges of the four-power control of the German ex-capital, organised at one time at the cost of much effort. The gloomy building in which the Allied Control Council used to be, now houses what is known as the Air Safety Centre. Americans, Britons, Russians and French have sat here peacefully since the beginning of the air-lift in an endeavour to live up to the name given to their organisation. All aircraft of "Operation Vittles" are recorded continuously, arrivals and departures being marked on blackboards just as in the control posts of large airports anywhere else. Even the representative of the Soviet Union has a blackboard. But since there is no control over the Russian aircraft, all that this blackboard usually features are such laconic reports as "... fighter exercises between 08 00 and 17 00 in the area of Berlin ..." And as these reports seldom reach the Air Safety Centre until a few hours after the "fighter exercises" have begun, the main job of the Russian representative really consists in receiving protests from the Western occupiers. During the first four months of the air-lift, this building was the scene of about fifty aural and ten written protests from the Western powers, which were handed with more or less ceremony to the Russian representative, who in turn accused the Anglo-American flyers of approximately one thousand air space violations. The Air Safety Centre therefore became the place from which the most alarming newspaper reports on incidents over Berlin took their usually harmless origin. May it remain so.

There is in reality no confusion here. Trucks in the foreground are waiting at this Frankfurt "maintenance base" until the necessary aircraft checks have been executed before they can carry their loads out to the aircraft. The Douglas C-54s in the background still feature the red tail markings which mean that they have been in operation in Alaska.

German airports, administration buildings, control towers and workshops are in day-and-night operation. Rhein-Main airport, Frankfurt, which was to have been Germany's main civil aviation facility, was rapidly adapted for continuous operations. Now fitted with the latest in navigational aids, it is devoted exclusively to "Operation Vittles."

DRILLING TEMPLATE OF PLASTIC. Resin-impregnated fibreglass cloth laid-up over the plaster form, shown in the left-hand photo, is enclosed in a transparent, airtight moulding bag. When the latter has been pumped empty of air, the entire assembly is placed in an oven to cure the plastic. An important characteristic of the plastic material used, is that it can be cured under heat at atmospheric pressure. The bag, emptied of air, serves as a press. On the right can be seen the finished drilling template of plastic, with steel drilling holes, which will be used for drilling rivet holes in a wing leading edge.

Plastics Become Active

Plastic, malleable, shapable . . . are words which, when used in everyday language, conjure up the idea of a passive character. And if—rightly or wrongly—we apply the word "plastic" to all synthetic resinous materials, then we convey the idea that these are materials which can be fashioned very easily, but only participate as bonding media in structures where major forces are transmitted. It is only with the utmost caution that we use them for aircraft components that are subjected to large stresses. The so-called "plastic aircraft," about which we hear far less nowadays, were invariably constructions in which the wooden or laminated parts were impregnated with synthetic resin and then joined together. To the best of our knowledge, no aircraft having, for instance, solid plastic wing spars without longitudinal reinforcement, has ever flown.

But we will perhaps hear of this in our lifetime ; for the technique of plastic manufacture is progressing in two respects as far as aircraft construction is concerned. On the one hand, we are amazed to see the large transparent plastic canopies over the cockpits of modern fighter aircraft ; these feature no reinforcement which might disturb their visibility characteristics, and they all the same resist the enormous air pressures occurring at high speed—an impressive proof of the strength already achieved in plastic manufacture today. On the other hand, experts are continually finding new reinforcing materials which, endowing plastic parts with increased strength, widen their field of application.

One of the latest slogans is "glass aircraft." These are not, as one might be led to think, aircraft built of exceptionally thick bottle glass. They are made of plastic material which has been rendered more rigid by a reinforcement in the form of fibreglass cloth. Proverbially brittle as thick glass may be, when spun into thin strands it is exceptionally flexible, strong and light, and especially if the fibres are encased in an appropriate plastic material.

This compound material of plastic and fibreglass is characterised by its excellent plasticity in the state in which it is delivered. The malleability of the plastic casing is equal to that of the fibreglass reinforcement. Just as artistically-cut cloth assumes the contours of the human body, these reinforced plastics are able to take the shape of aircraft parts much better than sheet metal or plywood. After brief curing in the oven, they harden into rigid, shock-resistant and strong aircraft parts.

For the present, however, metal aircraft are more urgently needed than "glass aircraft," which are still only in the early blueprint stage. But the new material is nevertheless very useful in their production. We know that the line production of metal aircraft requires a multitude of tools, such as fixtures for drilling, routing, spot-welding and assembly operations ; hitherto manufactured at high costs from steel, these are also inconvenient to handle because of their great weight. If one can replace the steel, which is expensive and universally in short supply during wartime, with a compound material of plastic and fibreglass, then the tools will be much cheaper and lighter in weight, and still sufficiently strong.

During the past three years Republic Aviation Corp., of Farmingdale, L. I., has been developing and studying methods for using this compound material, which it calls "moulded laminate," in the production of tools and parts. Material suppliers who have worked with the company are Owens-Corning Fiberglas Corp., and E.I. duPont de Nemours, Inc. (manufacturers of plastic materials). The accompanying photographs give an idea of the wide field to which moulded reinforced plastics can be applied. It is also understandable that the Industrial Planning Division of the U.S. Air Force's Air Materiel Command insists that other American aircraft manufacturers should acquaint themselves with this process, and keep it in mind when making preparations for eventual high-level wartime production.

Previously one had only been able to shape plastic parts in metal moulds, but nowadays we can use plastic moulds to shape metal parts. The once passive material has become active.

A LIGHTWEIGHT TOOL like the above moulded laminate tool for manufacturing light-alloy ribs, could never be manufactured from steel.

FOR MANUFACTURING A LARGE ALUMINIUM PART for the Republic F-84 "Thunderjet" jet fighter, the above moulded laminate tool is used.

FORMING A BATTERY DRIP TRAY of reinforced plastic in the electrically-heated mould. After curing for one and a half minutes at low pressure, the part is ready for trimming.

Resistance Wire Strain Gauges and their Application

By Walter RAMBERG, National Bureau of Standards, Washington, D.C.

1. *Introduction*

The wire resistance strain gauge is one of the simplest devices for measuring mechanical quantities. A fine wire is attached to the structure and is strained along with the structure. The strain in the wire causes a proportional change in resistance which is then measured and recorded.

It is not surprising, in view of the inherent simplicity of the wire strain gauge, that it is now being used in quantities of the order of a quarter of a million a year in the United States. However, it is surprising that the popularity of the wire strain gauge is confined to the last ten years, although the principle has been known for over a hundred years, and that it is confined to one country, namely the United States.

I believe that the principal reasons for the long delay in the application of the wire strain gauge are, first, absence of a simple way of fastening the wire to the structure so that it would be strained along with the structure in compression as well as in tension; second, the difficulty of measuring the very small strains that have to be measured, *i.e.* changes in resistance that are usually less than one part in a thousand.

Mr. E. E. Simmons, at the California Institute of Technology, overcame the first difficulty by mounting the wire on a piece of thin paper which was then glued to the structure with cellulose nitrate (" Duco ") cement. Others working in the United States, among them Clark, Dätwyler, Ruge, and de Forest, contributed their own techniques for attaching fine wires to the structure on which the strain has to be measured. The solution of the second problem, that of measuring the small changes in resistance corresponding to elastic strains, was favoured in the United States by the high state of development reached in connection with instruments for controlling industrial processes. The application of strain gauges in the United States received its most powerful impetus from the requirements of war to estimate stresses in aircraft, tanks, guns, ships, etc., under many types of service.

The lack of popularity of the wire strain gauge in Europe may be due in part to the greater " resistance " of Europeans to electrical methods for measuring mechanical quantities. A second factor may be the greater reliance of Europeans on analysis for the determination of stresses in structures. A third factor, and perhaps the most important one, has been the discouraging experience of many European research engineers in their first trials with wire strain gauges.

In view of this situation it seemed worth while to publish a paper on this phase of strain analysis in a periodical of international circulation such as *Interavia*, which would summarise our present knowledge on wire strain gauges and discuss their field of application.

2. *Principle*

The principle of the wire strain gauge is usually derived from Ohm's law on the assumption that the wire is strained along with the structure to which it is attached. If the strain under the wire is a tensile strain ϵ, the length l of the wire increases by a relative amount :

$$\frac{\delta l}{l} = \epsilon \qquad (1)$$

The cross-sectional area A is decreased at the same time by a relative amount δ A/A. The relative change in cross-sectional area for a wire of isotropic material is

$$\frac{\delta A}{A} = -2\nu\epsilon \qquad (2)$$

where ν is Poisson's ratio. Neglecting changes in resistivity, the relative change in resistance Δ R/R corresponding to these changes in dimensions is given by Ohm's law :

$$\frac{\Delta R}{R} = \frac{\delta (l/A)}{l/A} = \frac{\delta l}{l} - \frac{\delta A}{A} = (1+2\nu)\epsilon \qquad (3)$$

Poisson's ratio for metal is generally of the order of 0.3. Hence we would expect a calibration factor K, for strain sensitivity,

$$K = \frac{\Delta R/R}{\epsilon} = 1 + 2\nu \sim 1.6 \qquad (4)$$

on theoretical grounds. Actual tests of wires have shown calibration factors at low strain ranging from K = —11 for nickel to K = +4 for iron, which shows that all wires do not behave as isotropic cylinders of constant resistivity following Ohm's law. For the commonly-used advance or constant wire, K is close to 2. The calibration factor K approaches 2 for all wires as the wire stretches plastically at strains of the order of 0.01. This might be expected from equation (4) upon substitution of the value $\nu = \frac{1}{2}$, which is characteristic of an incompressible isotropic solid. There is some basis for believing that the variations in strain sensitivity for different wires is due to changes in specific resistivity with strain in the elastic region. In the plastic region, the specific resistivity apparently remains constant and the strain sensitivity is dependent on dimensional changes alone.

3. *Description*

Literally dozens of types of wire strain gauge were developed during the war in the laboratories of the various American aircraft-manufacturing companies for their own use. No attempt will be made here to describe any of these, since they are not generally available. The present description is confined to the gauges that are made available commercially by the Baldwin Locomotive Works (Baldwin Southwark Division, Eddystone, Pennsylvania) under the trade name " SR-4 Gauge. " Even for measuring one-dimensional states of strain, it mostly happens that, instead of a single length of wire being used, the wire is folded several times across the spot where the strain is to be measured. The most widely used gauge is the SR-4 type A-1 gauge shown in figure 1, which has a gauge length of about 13/16 inch and a resistance of about 120 ohms. It is attached to the structure with " Duco " cement and is ready for use after it has been allowed to dry thoroughly. Infra-red lamps are often used to accelerate the drying of the cement. Other SR-4 types range in gauge length for 1/6 to 6 inches and in calibration factor from 1.7 to 3.5. Special gauges are available for measuring strains at temperatures up to 300 deg. F., two-dimensional states of strain with rosettes (types AR-1 to 4 and CR-1 to 4), strain along a narrow line with a single wire, or circumferential strain on circular plates with spiral wires (type S-1). Obviously, there is no limit to the possible variations of special strain gauges.

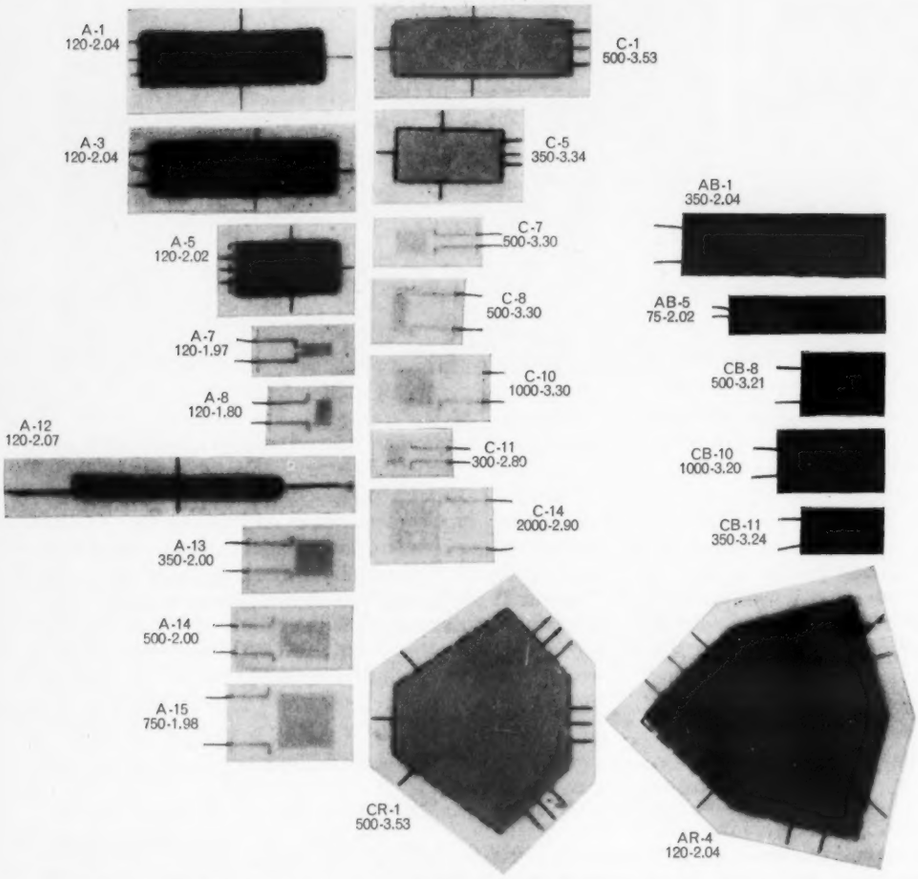


Fig. 1 : Commercially-available wire strain gauges, SR-4 types. Type number, resistance R and calibration constant K are indicated below each gauge.

4. *Characteristics*

The possibilities of the wire strain gauge will not be fully utilised until more is known about its basic characteristics. A good beginning has been made by studying the characteristics of wire strain gauges at room temperature — thanks, principally, to the work on performance tests of wire strain gauges which was conducted by William R. Campbell at the National Bureau of Standards on behalf of the National Advisory Committee for Aeronautics (cf. references 1 to 6 at the end of the article). The results of some of this work will be summarised below.

a) *Calibration factors in tension and compression*

Fig. 2 shows calibration curves in tension for a typical wire strain gauge, taken from reference 1, together with the corresponding deviation curves. The latter curves show the deviation from a straight line corresponding to an average value of the calibration factor for gauges of this lot. The calibration factor for each gauge is given by the average slope of the calibration curve. Similar curves are obtained in compression calibrations (reference 2). From many such calibration curves it appears that the calibration factors in tension and compression of the commonly used SR-4 gauges are identical, that they agree within $\pm$ 1 per cent. with the factor given by the maker of the gauge, and that one may expect to measure strains up to 0.002 with an accuracy better than $\pm$ 2 per cent. with such gauges. The accuracy will be less for gauges of shorter gauge length. It may be much greater for special gauges of judiciously selected wire, carefully attached with selected bonding media.

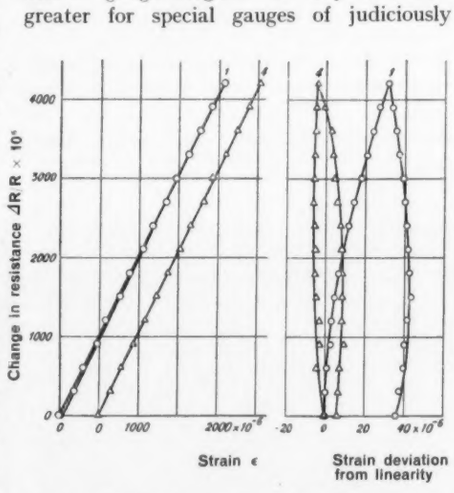


Fig. 2 : Calibration and deviation curves for an SR-4 type A-1 wire strain gauge, for first and fourth cycles of loading.

The linearity of change in gauge resistance with strain may be improved by cyclic application of the maximum strain to which the gauge is to be subjected in service. An example is given in figure 2, in which the maximum deviation for an A-1 gauge strained to 0.002 was reduced from 2 per cent. during the first loading to 0.5 per cent. after four cycles of loading.

b) *Measurement of large strains*

Figure 3 shows a curve of change in resistance as a function of strain for an A-1 gauge carried into the plastic range to a strain of 0.03. The relation between change in resistance and strain remained linear within 3 per cent. up to a strain of 0.03. Tests with gauges having other calibration factors at low strains (reference 3) showed that the factor approaches 2 at large strains, as might be expected from the theory.

The gauge is likely to fail at a tensile strain between 0.01 and 0.03. The failure occurs usually at one of the welds connecting the relatively heavy lead wire to the fine strain sensitive wire. The strain sensitive wire itself is capable of an extension of the order of 7 per cent. (reference 7).

c) *Response to transverse strains*

The width of the wire grid in many wire strain gauges makes the gauge slightly sensitive to transverse strain. The effect will depend on the proportion of wire that is strained by the strain at right angles to the gauge line. The effect is so small in most cases that it need be considered only when the transverse strain is greater than the longitudinal strain to be measured by the strain gauge. A theoretical estimate of the effect can be obtained by considering the amount and orientation of wire wound parallel to and transverse to the gauge axis. A semi-circular loop of diameter d has an equivalent length in the direction of the transverse strain equal to $\frac{1}{2}\,d$.

The transverse effect may be expressed by a transverse calibration factor K defined in analogy to (4) by

$$K_t = \frac{\Delta R/R}{\epsilon_t} \qquad (5)$$

where ϵ_t is the transverse strain.

The transverse calibration factor may be determined by attaching the gauge to a specimen that can be subjected to a known change in state of strain, in which the ratio of axial to transverse strain is changed by a large factor. The results of such measurements made at the Bureau of Standards showed ratios of transverse to axial calibration factors that ranged from —0.007 for type A-7 gauges to +0.028 for type A-5 gauges. The ratio is about 0.014 for an SR-4 type A-1 gauge.

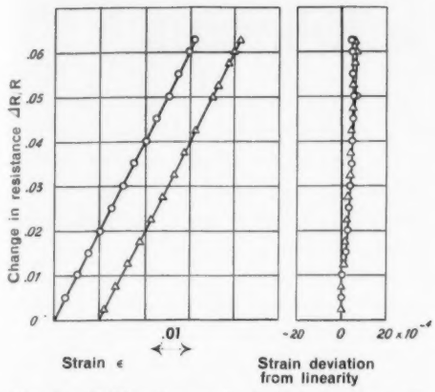


Fig. 3 : Calibration and deviation curves for an SR-4 type A-1 wire strain gauge at large tensile strains.

The negative values of transverse sensitivity are explained on the basis of gauge geometry. They are characteristic of gauges in which the strain sensitive grid is formed by wrapping the wire around a flat core, as shown by Baumberger and Hines, who have reported ratios of transverse to axial sensitivities, for SR-4 strain gauges, which range from —2 to +4 per cent. (reference 8).

d) *Effect of finite gauge thickness*

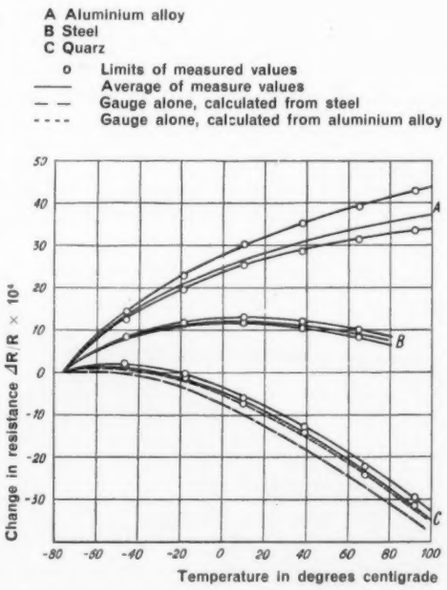
The finite thickness of the wire strain gauge causes an error in indicated strain when the gauge is used for measuring bending strains on thin sheet. The gauge will indicate a bending strain that is larger than the extreme fibre bending strain in the sheet because the strain sensitive wire is removed further away from the neutral surface of the sheet.

At the same time there will be an effect of the opposite sign if the gauge is stiff enough to reduce the strain in the region of the sheet in which it is attached. Measurements executed with SR-4 type A-1 wire strain gauges have indicated that the first effect predominates in these gauges and that it may lead to an error in indicated bending strain of the order of 18 per cent. on 0.026-inch aluminium-alloy sheet (reference 5).

e) *Effect of changes in temperature*

Apart from the strain that is usually associated with a change in temperature, also the resistance of the wire strain gauge alters when the temperature varies. The effect was assessed at the National Bureau of Standards by measuring the change in resistance of gauges attached to unloaded steel and aluminium bars as the temperature of the bars was varied from —73 deg. C. to +93 deg. C. The effect of thermal strain was eliminated by computing the strain caused by the thermal expansion of the metal and subtracting the change in resistance corresponding to this thermal strain from the measured change in resistance. The remainder then represents the change in resistance, with temperature, of a gauge attached to a material which does not change in dimensions with temperature. The computation was checked by observing that the curves for a given type of gauge attached to steel and to aluminium alloy were in close agreement. It was also found that the computed variation of resistance with temperature agreed with that measured for quartz, which has a very low coefficient of thermal expansion. Figure 4 shows the results for SR-4 type A-1 gauges attached to steel, aluminium alloy, and quartz. It appears from the dotted curves that the effect of temperature on resistance is decidedly non-linear. Fortunately, the effect of temperature on resistance was found to repeat itself within narrow limits for gauges of a given type. This makes it possible to compensate temperature effects in a Wheatstone bridge by balancing the output of an unstressed dummy gauge subjected to the same temperature as the stressed gauge, against that of the stressed gauge. It is stated in reference 6 that gauges with a calibration factor near 2.0, connected in adjacent arms of a Wheatstone bridge, may be expected to show an apparent strain with changing temperature of not more than 5×10^{-6} per degree centigrade, this being due to lack of perfect temperature compensation between test and dummy gauges.

Fig. 4 : Variation of gauge output with temperature.



f) *Stability*

The wire strain gauge, like any other strain gauge, must remain stable during its utilisation. Above all, the calibration constant must remain the same and the zero shift should be negligible between checks. These requirements are easily met in the laboratory as long as the gauge is not exposed to large variations in temperature or to excessive humidities, and as long as it is used for measuring strains inside the elastic range. In the laboratory it is usually possible to reduce the load periodically to a known initial value and thereby check that no appreciable zero shift has occurred.

It is more difficult and sometimes impossible to assure stability in the field, particularly if the gauge is exposed to extreme variations in weather or if it is placed on a vibrating structure. Experience with wire strain gauges has shown that they may peel off after prolonged exposure to the elements. The peeling will be postponed and it may be avoided altogether by taking special precautions in attaching the gauge. These precautions include thoroughly cleaning, with emery paper and alcohol, the metal surface on which the gauge is to be attached, heating the surface to prevent chilling between bonding material and metal, applying uniform pressure over the gauge while it is being attached, drying it thoroughly, and finally sealing it, against moisture absorption from the outside, by means of a waterproofing compound (*e.g.* a micro-crystalline wax such as " Petrosene "). Waterproofing of the gauge is especially important if use is made of bonding media like acetate cements (" Duco "), which tend to swell in the presence of moisture. This swelling will cause a zero shift if not an actual separation between gauge and structure. A cover of tape or metal may be added to protect the gauge against mechanical damage.

A second type of zero shift results from vibration superimposed on the strain that is to be measured. Vibration, just as water absorption, does not seem to affect the calibration factor as long as there is no actual separation of the gauge from the structure, or an actual fatigue failure in the leads of the gauge.

Large zero shifts may be expected at ambient temperatures that are high enough to affect the stability of the bonding medium. This is an important problem concerning which a great deal of research remains to be carried out.

(Continued in the next issue.)

The Different Ways of Compensating Torque in Helicopters

By Walter JUST, D.Sc. *(Conclusion*)*

From the standpoint of dynamic stability, the single-rotor design by Bell Aircraft Corp., with two gyro-stabilised rotor blades, constitutes a noteworthy exception,[3] but unfortunately has the disadvantage of featuring, at high flying speeds, major fluctuations of the forces and moments coming from the rotors.

Let us return to the four-rotor construction (No. 2) : we had the advantages of relatively simple design of the rotor head and superior flight characteristics at altitudes where the ground effect is no longer in evidence. Disadvantages, on the other hand, include the greater number of rotors, and their outriggers which furnish a great amount of additional drag in forward flight. Furthermore, a loss in power is caused by the rear rotors having to work in the downwash of the front ones, thereby offering considerable drag. Owing to the small aspect ratio of the rotor discs, $\Lambda = D^2 : D^2\ \pi/4 = 1.273$, the downwash is relatively strong, with a result that the drag increase of the rear rotors cannot be disregarded.

No. 3. The Cierva Autogiro Co., Ltd., of Southampton, England, is currently building a three-rotor helicopter with one rotor at the fuselage nose and two on either side of the fuselage rear. In this case, the same reasoning may be applied as to example No. 2 : advantages are the simple design of the rotor heads, and damping about the lateral and longitudinal axes ; disadvantages are the three rotors, the two outriggers furnishing a high degree of drag, and a drag increase owing to the rear rotors having to work in the downwash of the front rotors. In the Cierva design, all rotors turn in the same direction, giving rise to a stabilising influence due to gyroscopic effect. In order to compensate torque, however, the rotor shafts have to be tilted for the side components of the thrust to give rise to the necessary compensation (cf. also No. 8). Since the torque moments vary with the state of flight, it must also be possible to vary the angle of tilt of the shafts, which entails a complication of the construction.

Two Rotors

No. 4. Many helicopters have been built with superimposed, contra-rotating rotors —*e.g.* by Pretroczy, Berliner, Pescara, Asboth, d'Ascanio, Bréguet—and are still being built today by Bréguet, Bendix, and others. Attractive as it may appear, this solution nevertheless features a number of disadvantages : owing to the flapping movement of the blades in full flight, the two rotors may not be located too near to each other ; and this results in a heavier rotor head. Furthermore, a number of constructions have presented difficulties during autorotation (autogyro state with engine cut out), since either the upper or the lower rotor turns at normal r.p.m. and the other rotates very slowly. Although this need not signify a loss of lift, since the exposed area and not the number of blades is primarily responsible for lift, the flapping movement, if the rotor is turning too slowly, can become exaggerated and cause the blades to hit each other. This danger may be eliminated by installing a gear arrangement which has to remain effective during autorotation. Some types gave evidence of blade oscillation as a result of the rotors influencing one another, thereby leading to fatigue failures. Meanwhile, practical experience has shown that all these difficulties can be overcome by well-thought-out construction. Since construction No. 4 requires no outrigger, it furnishes less drag than designs Nos. 2, 3, and 5, and is therefore superior to them from the standpoint of performance. The sole disadvantage of this design is the somewhat more complicated and heavy rotor head.

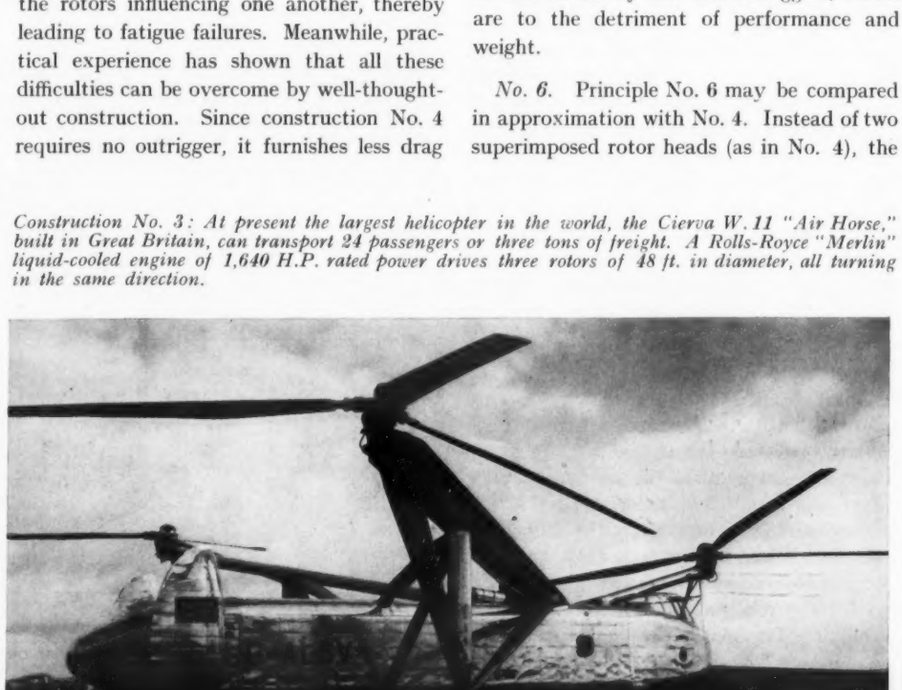
No. 5. The principle of contra-rotating, lateral rotors has been applied by Oehmichen, Focke, Landgraf, McDonnell, and others ; and the Russian " Omega " helicopter is also designed along these lines. Its relatively clear and simple structure makes it easy to understand why—alongside the Bréguet helicopter—it was the first really successful design (Focke Fw 61 and Fa 223). Briefly stated below are the flight performance data on the three above-mentioned types :

Type		*Bréguet*	*Fw 61*	*Fa 233*
Compensation		No. 4	No. 5	No. 5.
Year		1935	1937	1939
Gross weight	lbs.	5,000	2,100	9,500
Max. speed	m.p.h.	67	76	113
Ceiling	ft.	520	11,300	24,600
Range	miles	27	145	435
Duration	hrs.	1.04	1.33	—

A great disadvantage of construction No. 5 is constituted by the two outriggers, which are to the detriment of performance and weight.

No. 6. Principle No. 6 may be compared in approximation with No. 4. Instead of two superimposed rotor heads (as in No. 4), the

Construction No. 3 : At present the largest helicopter in the world, the Cierva W. 11 "Air Horse," built in Great Britain, can transport 24 passengers or three tons of freight. A Rolls-Royce "Merlin" liquid-cooled engine of 1,640 H.P. rated power drives three rotors of 48 ft. in diameter, all turning in the same direction.



[3] Cf. INTERAVIA, Review of World Aviation, Vol. III, No. 12, pp. 681-682.

[3] A. M. Young —" The Helicopter and Stability. " INTERAVIA, Review of World Aviation, Vol. II, No. 6, pp. 41-42, and No. 7, pp. 27-32.

two rotor heads are positioned side by side and very near to each other. In order that the blades of the two rotors should not collide, there is a gear arrangement which maintains the proper distance between them, and is therefore of vital importance. Even though the probability of a gear failing is very slight, nowadays, many designers nevertheless prefer to entrust their lives to a ball bearing arrangement. Owing to the large negative dihedral which the two rotors have to feature in the interest of freedom of motion, there can result, as practice has shown, a certain screening of the one rotor by the other. Protagonists of this principle include Flettner, Kellett, SNCA du Centre, and so forth.

No. 7. Cornu was certainly the first to use this arrangement (contra-rotating tandem rotors), which is now to be found in the twelve-seater Piasecki commercial helicopter. It appears to be very advantageous since there are no disturbing outriggers. Merely the extra drag of the rear rotor, which lies in the downwash of the front rotor, signifies a disadvantage.

No. 8. The construction with two rotors in tandem, turning in the same direction, was tried out in Belgium by Florine. As both the rotors turn in the same direction, their shafts are tilted, with the result that the side components of the thrust compensate the torque moments. In order to enable modifications in torque moment to be compensated, the amount by which the rotor shafts are tilted to the side must be adjustable (cf. also No. 3). With the help of gyroscopic forces, which are notably lost in helicopters with contra-rotating rotors, a certain amount of stability was obtained in this connection, but the blades—in order to acquire sufficient effect from the gyroscopic forces—had to be connected rigidly with the hub, a feature giving rise to very great disadvantages from the standpoint of strength. Even during hovering flight, there occurred failures at the blade roots as a result of gusts. In forward flight the strains are much higher, because of the periodic air forces.

One Rotor

No. 9. Here the blades are driven directly by small propellers, so that no torque compensation is necessary. Hellesen-Kahn, Isacco, Curtiss-Blecker, and others, tried this principle. Apart from operational difficulties, large gyroscopic forces of the propellers, rotating engine parts, etc., the greatest disadvantage is the fairly high loss of power, which comes more into evidence in view of the efficiencies of the small propellers. It is probably in the neighbourhood of thirty per cent., whereby the conditions are especially unfavourable in forward flight.

Construction No. 4 : A Bendix helicopter (Type K) with centrally-positioned contra-rotating rotors driven by an 85-H.P. Continental engine.

Construction No. 6 : The Kellett XH-10 helicopter built for the U.S. Air Force, powered with two 525-H.P. Continental engines, is characterised by contra-rotating rotors which intermesh. The rotor axes form an angle of 25 deg.

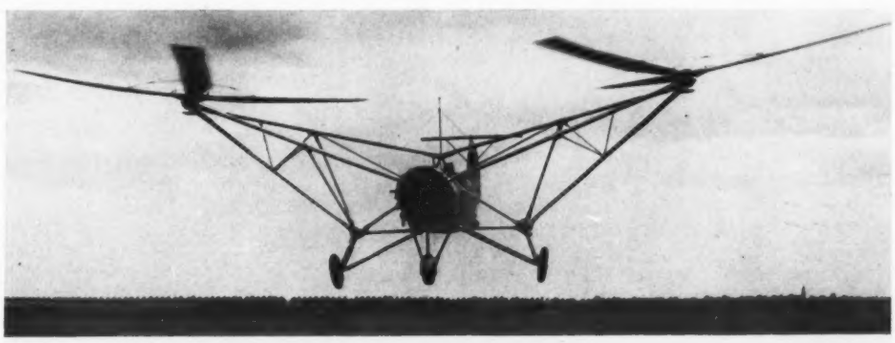
No. 10. Propulsive ducts, as first proposed by Papin and Rouilly, which likewise require no torque compensation, seem to offer wider possibilities. Use could be made of pressure ducts at the blade tips, which receive the mixture of fuel and air from a compresser housed in the fuselage (Dobblhoff, SNCA-SO), ram-jets (McDonnell, Just-Fleck), or pulse-jets (Marquardt). Propulsion by ram-jets involves the smallest conceivable weight, which can be very useful in special cases, *e.g.* for a strap-on design of helicopter.[4] Unfortunately the fuel consumption of ram-jets is extremely high, so that duration and range are considerably lower than in the case of conventional engines. However, if the ducts are only used for taking-off and landing, and a normal propeller is used in forward flight, thus with the aircraft flying as an autogyro (SNCA-SO 1100), this solution seems to offer better prospects. But from the standpoint of performance—in the case of normal power loadings—flight as an autogyro is less favourable than flight as a helicopter.

Constructions Nos. 9 and 10, meanwhile, have a further disadvantage : the thrust of each of the small propellers (No. 9) or the ram-jets (No. 10) is by no means equal. If the rotor blades are attached by drag hinges to the rotor shaft (degree of freedom of the blades in the plane of the rotation), then, as a result of the different amounts of thrust, each blade will not carry out exactly the same movement as the other. This will result in considerable disturbances, occasioned by the very great centrifugal forces of the blades, which will not balance out. It occurs, therefore, that quite small differences in thrust from the propulsive ducts give rise to a considerable disturbance. Small differences in thrust will always be featured by such ducts, so that there is hardly any other way but to eliminate drag hinges and connect the blades in the plane of rotation rigidly to the rotor head. Meanwhile, this results again in disadvantages during forward flight, because the rotor forces feature large fluctuations, which have a very unfavourable effect from the standpoints of strength and flight characteristics.

No. 11. Here the blades are made to execute a predetermined flapping motion by means of a turning movement about the longitudinal axis, thereby resulting in a torque-free drive (Küssner). This principle has not yet been put into practice, and it is safe to guess that the given flapping motion will be accompanied by fairly great difficulties.

[4] Cf. INTERAVIA, Review of World Aviation, Vol. III, No. 4, p. 218.

Construction No. 5 : The single-seater Focke Fw 61 helicopter, powered with a 160-H.P. Sh 14 A engine, performed surprisingly well as long ago as 1937.

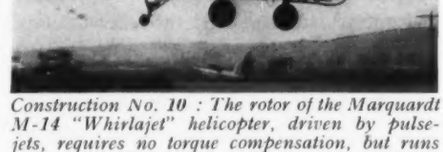


Construction No. 7 : The U. S. Navy's giant helicopter, the Piasecki PV-3 "Rescuer," has contra-rotating tandem rotors driven by a 600-H.P. Pratt & Whitney "Wasp" engine.

No. 12. Torque compensation by means of a rear propeller was first applied by Baumhauer (Holland), later brought to a successful conclusion by Sikorsky, and generally represents one of the most advantageous solutions of the problem. The Bristol Type 171 helicopter and the inherently-stable products of Bell and Hiller all use this principle of torque compensation. The small rear propeller does not require very much power, in fact about seven per cent. of the total engine output.

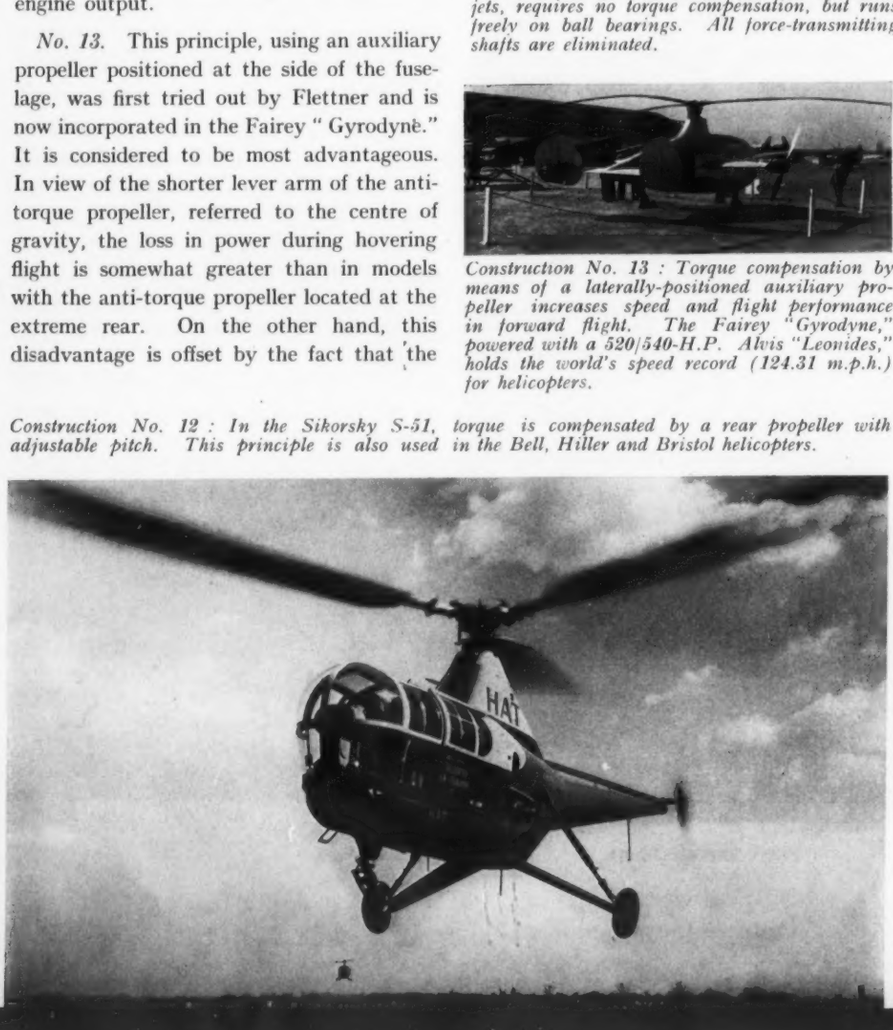
No. 13. This principle, using an auxiliary propeller positioned at the side of the fuselage, was first tried out by Flettner and is now incorporated in the Fairey "Gyrodyne." It is considered to be most advantageous. In view of the shorter lever arm of the anti-torque propeller, referred to the centre of gravity, the loss in power during hovering flight is somewhat greater than in models with the anti-torque propeller located at the extreme rear. On the other hand, this disadvantage is offset by the fact that the output of the anti-torque propeller is converted into useful propulsive power during forward flight—which thus brings us into the domain of the rotor-propeller aircraft. The outrigger nevertheless gives rise to additional drag.

Construction No. 10 : The rotor of the Marquardt M-14 "Whirlajet" helicopter, driven by pulse-jets, requires no torque compensation, but runs freely on ball bearings. All force-transmitting shafts are eliminated.



Construction No. 13 : Torque compensation by means of a laterally-positioned auxiliary propeller increases speed and flight performance in forward flight. The Fairey "Gyrodyne," powered with a 520/540-H.P. Alvis "Leonides," holds the world's speed record (124.31 m.p.h.) for helicopters.

Construction No. 12 : In the Sikorsky S-51, torque is compensated by a rear propeller with adjustable pitch. This principle is also used in the Bell, Hiller and Bristol helicopters.



No. 14. Torque compensation can also be achieved by the jet stream of a duct or the airstream of a blower, in conjunction with the exhaust gases of the engine (Weir). It is also possible, in forward flight, to use an obliquely-set fin partly or entirely to compensate the torque moment, especially at very high speeds.

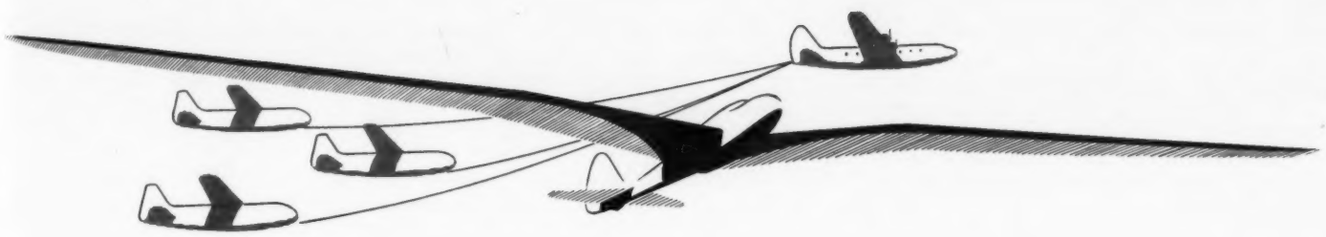
No. 15. In this design, a propeller blows against an obliquely-set fin and thereby furnishes a lateral force (SNCA du Nord). Whereas this principle is not very advantageous for hovering flight, since a fair amount of power is necessary for producing the required lateral force, it seems to work all right in forward flight (rotor-propeller aircraft).

No. 16. Finally, obliquely-set surfaces in the rotor stream can give the required torque compensation. Such surfaces which are rotatable about their longitudinal axes for lateral control must, however, be rather large (Nagler).

In addition, still further methods of torque compensation are conceivable, including combinations of the arrangements mentioned above.

It is no easy matter to decide on one given construction : solutions **1**, **9**, **11** and **16** can, in view of the level attained today, be cast out without further discussion. Constructions **4**, **7**, **12** and **13**, it would seem, belong to the future.

The great disadvantage of the helicopter is and remains its low maximum speed, which stems from the unfavourable characteristics of the rotor. Calculation shows that a normal helicopter will not exceed 300 km./hr. maximum speed by very much. As for the future, it seems certain that a combination of the helicopter with the normal aeroplane would result in greater progress with regard to speed. An aircraft of this type would take-off and land as a helicopter (*e.g.* with two lateral rotors), but obtain its lift from a small wing during forward flight. The rotors could then be tilted forwards or rearwards and used as conventional tractor or pusher propellers. In these circumstances, therefore, helicopter-rotors would only fulfil the rôle of take-off and landing aids. Meanwhile, in cases where the maximum speed is of secondary importance, the normal helicopter will certainly continue to earn its salt.



What Performance is Attainable in Soaring Flight ?

By Joachim KUETTNER, D.Sc., Zugspitze Observatory.

There exist types of sport for which one can largely determine the maximum attainable performance, and for which " records " can only be improved on thanks to exceptional personal talents or particularly favourable meteorological situations (for example, this applies to the majority of athletic sports). In the technical field, however, the limits of performance cannot generally be determined, for there are always two latent possibilities for further improvement : amelioration of the technical instrument, and exploitation of new sources of energy.

In a technical sport like soaring flight, there could be no further big surprises if improvements in performance were only to be anticipated from the individuality of the meteorological situation or of the pilot—thus, for instance, if a storm located particularly high, or a rare combination of stormy and uncertain weather, carried a sailplane exceptionally high or far, or if a sailplane pilot strained himself to the limit of human endurance (which would not be very sensible) in order to stay in the air for three or four days instead of two.[1] As a matter of fact, pilots have already attained the lower levels of the stratosphere, the tropopause, and sailplanes have climbed to 26,000 feet above the point of departure (or the lowest point of their flight), and 36,000 feet above sea-level, whereas maximum durations of flight have exceeded 50 hours and distances have reached the 465-mile mark, thus corresponding to the distance between Zurich and Belgrade or Berlin and Venice. Individual situations or performances may enable these records to be beaten, but not to be outclassed in principle.

Meanwhile, sailplane pilots have two further technical means of improving on their performance : improved aircraft design (aerodynamics), and exploitation of new sources of energy (meteorology).

The aerodynamic refinement of sailplanes, it would appear, has already reached such a high level that an appreciable improvement in performance would not be realisable without resorting to major and expensive modifications. Since a sailplane invariably represents a compromise between different characteristics (best sinking speed for altitude flight, best gliding angle for distance flight, best aptitude for curving in cloud flying, best manœuvrability for landing, greatest strength for gusts or for acrobatics, etc.), it is not possible to go to extreme measures without penalising one or the other of these characteristics, each one of which is an equally important property of the aircraft. Although valuable progress has been made recently in Switzerland (*e.g.* by " changing " one aircraft type into another during flight by means of the " camber flaps " of the WLM [2]), it seems that, from the standpoint of sailplane construction, no sensational improvements in performance are to be expected.

One fact, however, is outstanding : in order to attain still greater altitudes, a technical alteration is essential. The tropopause corresponds roughly to the biological limit altitude, above which it no longer suffices to use an oxygen mask because the feeble air pressure alone is mortally dangerous. Soaring flight in the stratosphere, therefore, calls for a pressurised cockpit. However, this does not present a very difficult technical problem, since it was solved many years ago for powered aircraft. But equipping a sailplane with a pressurised cockpit (this path has already been followed in Germany and France) is coupled with three disadvantages : increased weight (which means decreased performance), specialisation (contrary to the compromise solution) and high costs. The latter disadvantage weighs heavily in all countries where soaring is largely dependent on private initiative. The sailplane fitted with a pressurised cockpit, therefore, rather belongs in the domain of special research than in that of popular sport.

It is evident, therefore, that only the last possibility remains, namely that of increasing performance by exploiting new types of energy source. The motorless aircraft always has to employ atmospheric sources of energy, of which only those directed vertically are of practical utility. The procedure is simply that the rising masses of air lift the sailplane more rapidly than it descends (when gliding in these currents). These up-currents can originate from many different types of energy source ; and here lie the new possibilities which form the subject of the present discussion.

It is not by chance that no sailplane has so far succeeded in leaving the troposphere (the air below the tropopause in which the temperature, on the average, decreases with altitude ; all storms occur in the troposphere) and penetrating through the tropopause into the stratosphere (the portion of the earth's atmosphere which is free from all weather phenomena). In effect, most flights have been made in the " turbulent layers " of the atmosphere, or rather by using their source of energy, which is the " thermal instability " of the air. This, however, is lacking in the stratosphere. This instability is engendered by the different temperatures which the masses of air assume under the influence of the heating of the ground by the sun's rays. Like in a hot-air balloon, the warm air always has the tendency to rise until it encounters layers of air of the same specific gravity. The condensation heat of the atmospheric water vapour, which is liberated in the clouds, can increase this limit considerably, under certain circumstances lifting it up to the tropopause. Naturally, thermal soaring flight must end at the point where all rising air masses have a specific gravity which is superior to that of the environment, because the temperature does not continue to decrease as the altitude increases, but rather has a tendency to increase again. This applies precisely to the tropopause, above which the air masses are superimposed in a stable manner in the stratosphere and—like air above water—have no tendency to change place. All vertical

[1] As a matter of fact, duration flights no longer count as real performance flights.

[2] Cf. INTERAVIA, Review of World Aviation, Vol. III, No. 3, pp. 166-168.

motions, therefore, would have to come to rest here. At all events, this was the assumption of those who recommended the stratosphere as the zone of ideal conditions for commercial aviation.

We know today that this is not the case and that precisely the tropopause is particularly subject to atmospheric disturbances; and that it does not only feature the highest wind speeds (frequently over 135 m.p.h.) but, furthermore, seems to be the " origin " of atmospheric instability.

In reality, any layman ought to have been able to presume something of this sort, as the limit between air and water—which is extremely stable since air is 1,000 times lighter than water— is often violently agitated, and this always occurs when horizontal airstreams are present. The latter are not obliged to lie only in the air (storm at sea), but they can also reign solely in the water (rapids in a river with uneven bed). Movements of the stable air-water limit are always of an undulant nature.

Contrary to the thermal vertical motions in the unstable atmosphere, an undulant vertical motion in the stable layers of the atmosphere could, therefore, constitute a new source of energy. Whereas thermal soaring flight must be limited to the seasons of strong sunrays (summer) and to the troposphere, " wave flight " can also be effected during the winter in the troposphere, and even in the stratosphere, which is stable at all seasons. Though this type of soaring is being practised in many countries, it is still very much in its infancy. It is interesting to note that this type of flight owes its discovery to practical experience (Wolf Hirth) and not to science, because nobody thought that the undulant up-currents would be sufficiently powerful to support a sailplane. In reality, they are generally much stronger than the thermal up-currents.

Meanwhile, considerable progress has been made in the theoretical domain in recent years, and it is now possible—although this demands a great deal of mathematical effort—to reveal to soaring pilots how they can greatly surpass the present records, even to the point of doubling them. Notably two things appear as sure : altitude flight in the stratosphere, and motorless distance flights over stretches of more than 600 miles (corresponding roughly to the distance from London to Genoa).

To the sailplane pilot, altitude always signifies also distance in gliding flight, especially if strong winds prevail and carry the sailplane with them, thus giving it a high ground speed. This is always the case when soaring in waves, as strong winds are precisely a prerequisite to strong waves. Once a sailplane pilot has attained 33,000 to 36,000 ft., he can glide over 125 miles in two to three hours. During this time, however, the wind carries the aircraft once gain over the same distance. When working in altitudes like this, one can always count on a 250-mile down-wind flight.

Just as irregularities in a river bed give rise to rapids, mountains constitute the principle origin of atmospheric waves. Over large mountain areas (in Norway for example) there arise what one might call " air rapids, " which are made visible by wave-shaped clouds. During a glide of, say, 250 miles, a pilot will always look out for new mountainous regions and endeavour to discover new waves in order to prolong his flight. To this end, however, one ought to know something about the disposition of these waves ; and the foregoing facts are particularly important :

There seem to be two different types of wave : what might be called " limit-surface waves " (at the horizontal limits of intersection between cold and warm air), and " internal waves " (within an entire mass of air, thus in a way in a boundary layer spread over a great vertical distance). The two types of wave are frequently superimposed, and the internal waves seem to attain exceptionally great altitudes. Limit-surface waves are mainly found in the lowest layers of the troposphere (to 13,000 ft.) and at its upper limit, the tropopause (30,000 to 40,000 ft.). The internal waves fill in the space between these two limits as well as the space above them, provided the corresponding conditions are fulfilled : in theory, the centres of the up-currents of individual wave trains are piled up one above the other at an angle of about 45 degs. to leeward. If a number of mountain ridges are located one behind the other, astonishing possibilities may confront the sailplane pilot ; under certain conditions, he can climb on the normal slope up-current of the rear ridge and attain the high waves. Otherwise, it is mostly more difficult to reach the internal waves, as one must be towed to a fair altitude in order to connect with them.

Over wide valleys, there would be, in theory, very active up-current areas, unexpectedly spreading over large parts of the valley and extending to between 10,000 and 13,000 ft.

When strong winds come from the south or the north, large mountain ranges, such as the Alps, give rise to a powerful " breaker, " the so-called Foehn wave. This takes the shape of an immense train of waves, located between 25,000 and 45,000 ft. altitude, along the central Alps, frequently forming a dense cloud of 15,000 square miles or more. Still at 38,000 ft., at their front side up-currents have been measured which would lift a sailplane through 13,000 ft. in a quarter of an hour (flight by Klöckner). If the sailplane is equipped with a pressurised cockpit, then it ought to be possible, by means of a special flying technique, to attain the up-current centres of the second and third wave. It is probable that the latter comes to lie in a particularly high horizontal layer, this being due to the combination of Fœhn wave and cyclonic effect. Because of the condensation in the high stratosphere, this third wave becomes visible as what is sometimes called the " mother-of-pearl " cloud. Störmer discovered by measurement that these clouds—which, incidentally, are composed of very fine droplets of water, despite the fact that their temperature varies between -80 and -90 degs.C.—are almost immobile, being situated at altitudes of about 80,000 to 100,000 ft. A sailplane equipped for extreme altitudes and cold could be expected to attain over 65,000 ft., and even beat, without an engine, the world's absolute altitude record.

A different technique has to be applied for major distance flights. At the front edge of the Fœhn wave, at 33,000 ft. altitude, one can glide the length of a large range of mountains, at high speeds over many hundreds of miles (*e.g.* from the Swiss Alps to the region of Vienna). At the end of the mountain range, one starts on the down-wind glide in the direction of other mountain ranges. These do not need to be especially high, for sailplanes have already climbed to nearly 30,000 ft. over medium-high mountains—for instance, over the Riesengebirge (5,000 ft.).

For distance flights of this order of magnitude, one can use still another method, which is applicable in the Polar regions (for instance, in Northern Scandinavia). In these areas, strong winds from the west or the north-west give rise to widespread and regular turbulances, rotating about axes lying in the direction of the wind. The ascending branch of this turbulent stream forms long-drawn-out up-wind streets, and the turbulances themselves are frequently visible as streets of clouds. Similar phenomena exist in Central Europe, when thermal up-currents combine with strong horizontal winds. In the Polar Circle, however, there are additionally two favourable circumstances : long periods of daylight, and reinforced effect of the Earth's rotation. Whereas further south one can count on only about eight hours of thermal up-winds per day, in the Land of the Midnight Sun one comes across favourable streets of clouds one behind the other during periods of twelve to fifteen hours. Contrary to the usual practice of circling beneath the clouds, one can fly straight out at high speed. Here, too, distances of over 600 miles can be covered in this manner. The only serious setback, of course, is the difficulty of effecting landings and rescue operations in unexplored regions.

Incidentally, one also finds excellent conditions for duration flights along the coasts of the Arctic Ocean ; for instance at Pummanki, Lapland. Under certain meteorological conditions, Monsoon-type winds blow for weeks against the steep coast line (suitable terrains are nevertheless available for landings). Hence, if a pilot wanted to, he could fly for as long as he wished—certainly for at least a week if accompanied in a two-seater—in continual daylight, thereby realising in duration flight what is also possible for altitude or distance flight : doubling the existing world records.

Wind Tunnels with Energy Accumulation

By Otto FRENZL, B.Sc., Aéroplanes Voisin, Groupe O., Decize (Nièvre), France.

I. *Necessity for high-velocity wind tunnels*

Since the appearance at the beginning of this century of the first wind tunnels in Europe, which have enabled systematic research to be carried out in aerodynamics, the speed of aircraft has continually increased and has today approached and in some instances surpassed supersonic speed. In view of the compressibility effects, we can no longer make a simple direct transfer of wind-tunnel measurements made at low velocity, to the full-scale aircraft. An increased necessity has therefore arisen for special high-velocity and supersonic-speed wind tunnels, having approximately the following dimensions :

Test Section for high-velocity wind tunnels (sq. m)	Application
1) 0.01 to 0.1	Fundamental physical research.
2) 0.1 to 1	Systematic research ; research for industrial purposes.
3) 1 to 8	Research on industrial developments ; control of results obtained in cases (1) and (2) at higher Reynolds' numbers.
4) > 8	Tests with full-scale models.

For supersonic wind tunnels, smaller dimensions are sufficient, since the Reynolds' number plays a secondary rôle in the supersonic domain, and the disturbances produced by the model and reflected by the walls of the tunnel no longer meet the model when the walls are at a moderate distance. Nevertheless, this does not apply at supersonic speeds which only slightly exceed the speed of sound.

The high cost of construction frequently hinders the installation of such wind tunnels, which are indispensable to progressive development. An effort has therefore been made, and with success, to find new types of wind tunnel involving constructional and operational costs low enough for national research institutes and modern firms to be able to install them.

Before passing on the description of these installations, it will be profitable first to consider a number of general principles.

II. *Output*

The kinetic energy of a homogeneous flow, on a time basis (second), as it occurs in the test section of a wind tunnel, amounts to :

$$N = \frac{\rho \cdot F \cdot v}{2} \cdot v^2 = \frac{\rho \cdot F \cdot M^3 \cdot a^3}{2} \text{ (kgm/s)}$$

where :

ρ = density of the air (kg.s²/m⁴)
F = flow section (m²)
v = velocity of flow (m/s)
M = Mach number = v/a (dimensionless)
a = sonic speed (m/s)

In order to obtain an indication of the order of magnitude of this output, it may be noted that, for instance, an air stream of normal atmospheric density and temperature flowing at sonic speed ($M = 1$) possesses kinetic energy amounting to 32,500 metric horsepower per square metre of flow section.

The diffuser, which is nowadays nearly always located aft of the wind tunnel's test section, enables a part of this kinetic energy to be recuperated in the form of potential energy (pressure), so that the power necessary for a wind tunnel to function is generally lower than the kinetic output in the test section. Measured at the shaft of the blower, thus taking into account the losses of the blower, it amounts to about :

in closed-throat subsonic wind tunnels	0.07 to 0.25
in open-throat subsonic wind tunnels	0.35 to 0.7
in supersonic wind tunnels ($M = 2.2$) with half-open test section	0.8 to 1

of the kinetic energy in the test section.

Because of the drag furnished by the models and their supports, these values increase, especially in subsonic wind tunnels with closed test section.

On the one hand, the recuperation of energy in the diffuser, notably in subsonic wind tunnels or such with closed test section, is small ; and on the other hand, the methods tending towards a reduction of the kinetic energy in the test section are only applicable in conjunction with certain restrictions, or else in special cases. In consequence, the installation of large wind tunnels involves, first, the consumption of high outputs, which are only seldom available ; and second, considerable installation costs in view of the power of the machines.

It therefore seems indicated, especially in the case of large and very large installations, to replace the continuous-function, blower-driven types requiring high output, with designs characterised by an energy accumulator and intermittent function.

Charging the accumulator is continuous and only absorbs a moderate amount of power. The charging installations consume much less and are much more agreeable than the high-output machines of big wind tunnels without energy accumulation, which necessarily work irregularly and during relatively short periods, and are therefore not put to good purpose.

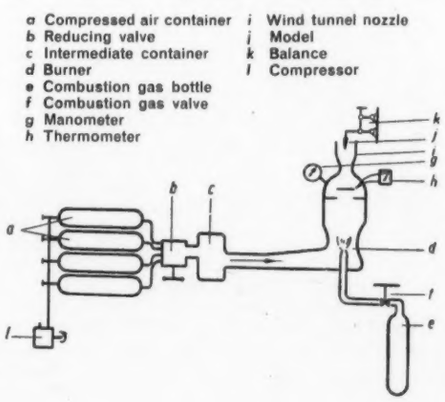
III. *Early types of wind-tunnel with energy accumulation*

Figs. 1 and 3 show certain earlier types of wind tunnel which have energy accumulators and work intermittently.

The small wind tunnel shown in Fig. 1, built in Russia, used a group of compressed air bottles as accumulator. Pressure and temperature of the nozzle were maintained constant by means of a reducing valve and a gas burner.

The proven type of wind tunnel shown in Fig. 2, which has been used on a large scale in Germany and in France, uses a container which has been pumped free of air and sucks the air through the test section. Because the air pressure before the suction point is equal to the atmospheric pressure, that is to say remaining practically constant during the short testing period, and sonic

Fig. 1 : Russian supersonic wind tunnel.



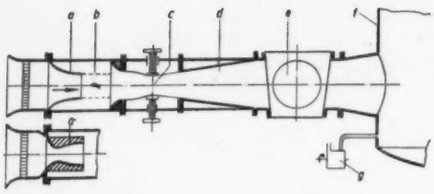


Fig. 2: Subsonic wind tunnel, Prandtl principle.

a Subsonic nozzle
a' Supersonic nozzle
b Test section
c Narrow section
d Diffuser
e Cock
f Vacuum container
g Vacuum pump

speed cannot be exceeded in the narrow part *(c)* of the wind tunnel, like in a Laval duct, the Mach number and dynamic pressure in the test section remain constant with reference to time, without the necessity of a special regulating system, for as long as the increasing pressure in the vacuum container suffices to maintain sonic speed at *c*. A modification of the cross-section at *c* influences the Mach number in the test section.

Fig. 3 shows, schematically, the type of wind tunnel built in Great Britain and the U.S.A. This is driven by an ejector fed by air from a compressed-air container. In view of the invariably high cost of large containers for accumulation, the function of such wind tunnels is generally restricted to a few seconds only. Also, the cross-section of their test section mostly measures only a few square centimetres or decimetres.

IV. *Wind tunnels with steam-jet drive and Ruths accumulator*

Forced by necessity to construct quickly and without too many man-hours or too much expense, a high-velocity wind tunnel at the Junkers works in Dessau, the author carried out tests with a view to utilising steam to drive a new type of wind tunnel

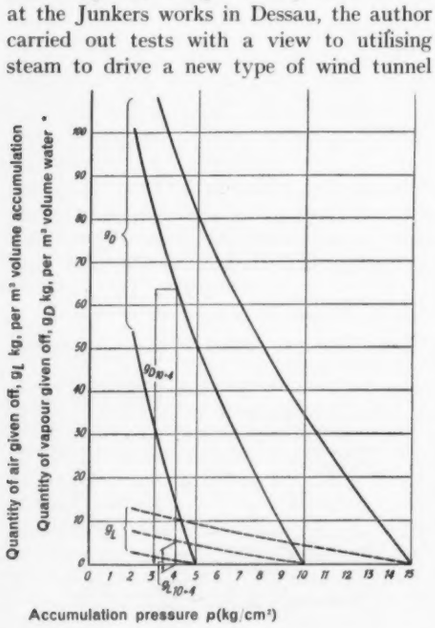

Quantity of air given off, g_L kg. per m³ volume accumulation
Quantity of vapour given off, g_D kg. per m³ volume water *
g_D
g_{D10-4}
g_L
g_{L10-4}
Accumulation pressure p(kg/cm²)

Fig. 5: Accumulation capacity of Ruths accumulator and compressed air accumulator.

* e.g.: $g_{D_{10-4}}$ quantity of vapour given off per m³ volume water, with an accumulation pressure drop of p = 10 to 4 kg/cm² Abs.

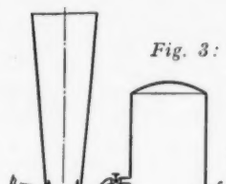


Fig. 3: Wind tunnel driven by compressed air jet.

a Test section
b Jet apparatus (ejector)
c Compressed air container
d Compressor

(Fig. 4) for which a Ruths accumulator (an insulated reservoir under pressure, partly filled with water) was used to store the energy.

For charging this accumulator, steam was simply passed through the water which it contained. Conversely, when it was discharged, a part of this water vaporised at the expense of the heat in the accumulator, thereby simultaneously causing a drop in pressure.

By ejector action, the steam sucked the outer air through the test section. After having slowed down in the diffuser, the mixture of steam and air left the wind tunnel. Like in the wind tunnels shown in Fig. 2, the Mach number in the test section was maintained constant by a narrowing of the pipe, in which sonic speed prevailed, adjustable air valves allowing for admission of the secondary air to the downstream end of the test section. At high subsonic velocities, of essential interest in this case, very small supplies of air were sufficient to vary the Mach number within wide limits, in view of the compressibility of the air.

Fig. 5 shows the quantity of vapour given off per cubic metre of water in the Ruths accumulator, plotted against the drop in pressure and, for the purpose of comparison, the quantity of air given off per cubic metre of a compressed-air accumulator.

Since the volume of water in the Ruths accumulator, admitted for purposes of comparison, is very considerable for wind tunnels of which the functioning period is not too short, and corresponds to 80 to 90 per cent. of the total volume of the accumulator, we see clearly that, per cubic metre, the Ruths accumulator furnishes a significantly greater amount of driving power than the air accumulator. Moreover, at equal pressures, the efflux velocity of the steam out of the ejector is, in view of the higher temperature, considerably greater than the velocity of the cold air. This is likewise of advantage to the functioning, and is reflected by the low power consumption.

Provided steam is available, the essential advantages of the type of wind tunnel described above are the practical elimination of a special charging apparatus (air pump and engine) and the relatively low cost of the Ruths accumulator.

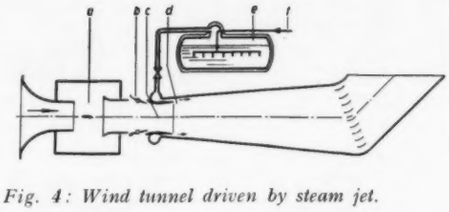


Fig. 4: Wind tunnel driven by steam jet.

a Test section
b Air valves
c Narrow section
d Jet apparatus
e Ruths accumulator
f Steam conduit for charging

Despite the rather low efficiency of ejector pumps, the operating costs incurred by wind tunnels equipped with them compare very favourably with those of installations where the blowers are driven by electricity. In effect, the direct conversion of steam energy into air-flow energy in the ejector is generally opposed, in the case of an electric drive, by a whole series of transformations of energy, beginning with the steam turbine and the electric generator, and ending with the rectifier, the blower and its engine, whose losses all add up. Besides this, the time required to start up an ejector wind tunnel is short, as there is no large revolving mass to accelerate. The ejector is simple, operationally reliable, and above all not sensitive to bits of the model or other extraneous particles carried by the windstream.

V. *The Junkers high-velocity wind tunnel*

The wind tunnel with jet-stream drive, shown in Fig. 6, was originally conceived solely as a model for testing the new design and for collecting research data obtained with partly novel measuring equipment. It was constructed by Junkers at Dessau and had a test section of about 900 sq. cm. in cross-section, which could be used for a multitude of purposes. Two old, unheated locomotive boilers served as Ruths accumulator, together giving a volume of water about 30 cu. m. and allowing the installation to function during several minutes at a time. After fulfilling its original purposes, it was kept in operation for studying aircraft designs, and furnished numerous results between 1941 and 1945. Notably, it enabled fundamental research to be carried out on the aerodynamics of the J 287 jet-propelled bomber.

Fig. 6: Junkers high-velocity wind tunnel driven by steam jet.

The diagram plotted in Fig. 7 shows clearly the behaviour of the wind tunnel with half-closed test section, for example. It shows the influence of the decrease in steam-pressure per unit time in front of the ejector, on the Mach number in the test section. For a fixed position of the air valves, the Mach number remains constant until the steam pressure drops below a certain value, and then decreases, which shows that the velocity in the narrow section of the tunnel has dropped to below sonic speed.

If the air valves are opened still more, the Mach number (which must be maintained constant) drops, but the elbow of the diagram also moves in the direction of lower steam pressures, which has a favourable influence of the consumption of steam per second and still more on the maximum duration of function of the wind tunnel. The dotted line in the diagram, which connects all the elbows, indicates the limit of the zone which can be regulated and in which optimum economic conditions are attained. In consequence, it seems advisable to use a reducing valve to maintain an approximately constant pressure which is slightly greater than that of the dotted curve.

As has been revealed by other tests, the Mach number drops again at higher pressures, roughly in accordance with Fig. 8*a*. The reason is that the air stream is narrowed at the downstream end of the pipe by the expansion of the steam jet (Fig. 8*b*), which acts as a solid body. In the vicinity of the narrow section of the pipe, the air stream may even detach itself from the wall. [1]

[1] A completely similar break-away phenomenon and a later expansion of the propulsive jet aft of the efflux nozzle was also observed during the study of the V-2 in the subsonic domain (S. F. Erdmann: "The Development of the V-2." — INTERAVIA, Review of World Aviation, Vol. II, No. 5, p. 31).

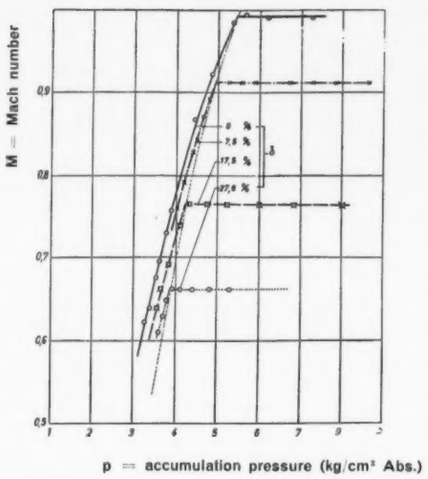
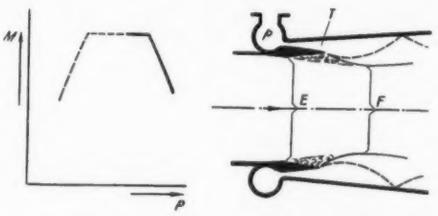


Fig. 7: Influence of steam pressure on the Mach number at different valve positions.

δ = valve position in percentage of fully open position



a

a) Influence on the Mach number

b

b) Flow in jet apparatus at high steam pressures
T = Steam nozzle
E = Narrow section of wind tunnel
F = Effective narrowing through steam jet

Fig. 8: Behaviour of jet drive at high pressures.

VI. *ATAR high-velocity wind tunnel*

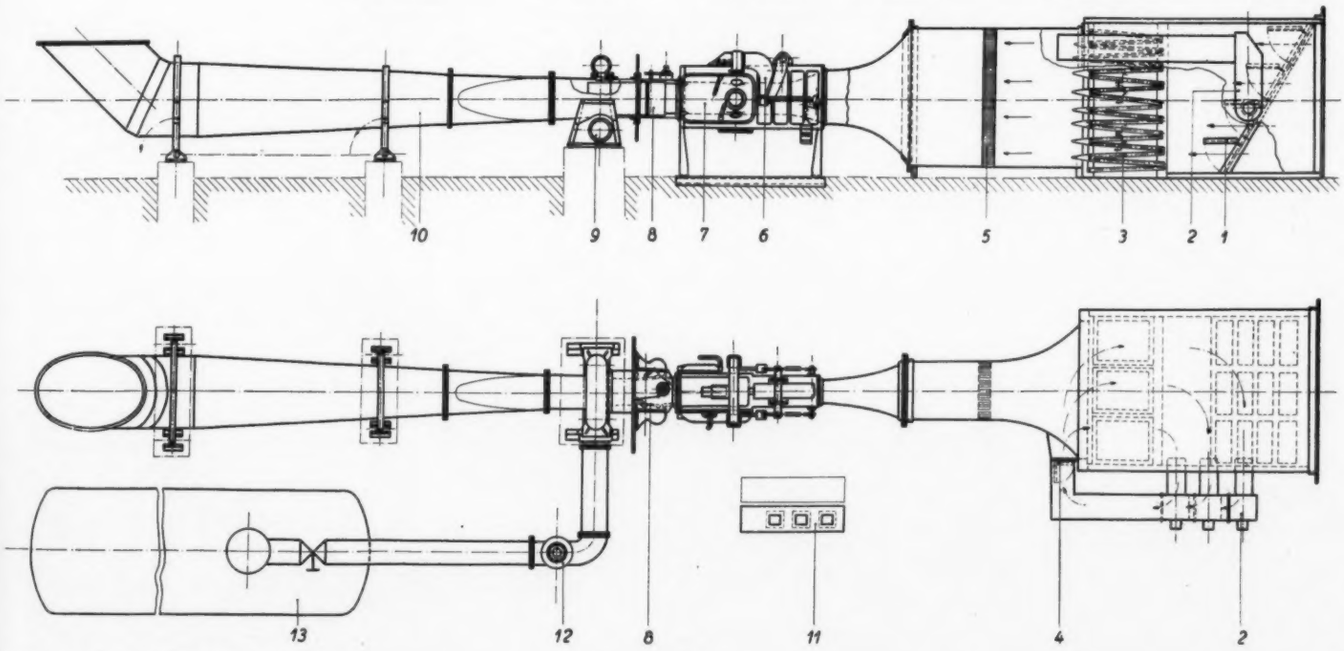
The transonic wind tunnel now being built near Paris by the SNECMA concern, shown in Fig. 9, represents a development of the high-velocity Junkers installation. It has a universal test section of 400 by 600 millimetres, and the functioning period lasts 2¼ minutes at sonic speed. In certain cases, by combining the fixed and free limits of the wind stream, a test section relatively free from the need for corrections can be created, which facilitates the interpretation of the measurements and assures precise results up to very near to sonic speed. Supersonic velocities can also be achieved by adapting special nozzles. Through this narrow limiting of the sonic speed, in whose immediate vicinity, because of the influence of the walls in wind tunnels, in principle no reliable results can be expected, it should be possible to interpolate fairly accurately the measurement results in this small "Mach-free" domain.

In order to avoid the condensation shocks which are dreaded during measurement (the condensation shock may arise owing to the cooling of the moist air, expanded after a sharp sub-cooling of the water vapour which it contains), the air sucked in is pre-heated through about 10 to 15 deg. C. on days when the air features a high degree of humidity. This causes the relative air humidity to be reduced and, as Oswatitsch [2] has shown, the occurrence of the condensation shock to be moved in the direction of higher Mach numbers.

[2] Oswatitsch, Göttingen: FB 1418, "Die Nebelbildung in Windkanälen und ihr Einfluss auf Modellversuche."

Fig. 9: ATAR high-velocity wind tunnel driven by steam jet.

1 Entry air valve
Air pre-heater
3 Gravel layers
4 Air valve
5 Rectifier
6 Balance
7 Test section
8 Regulating valves
9 Jet apparatus
10 Diffuser
11 Measuring desk
12 Steam pressure reducing valve
13 Ruths accumulator



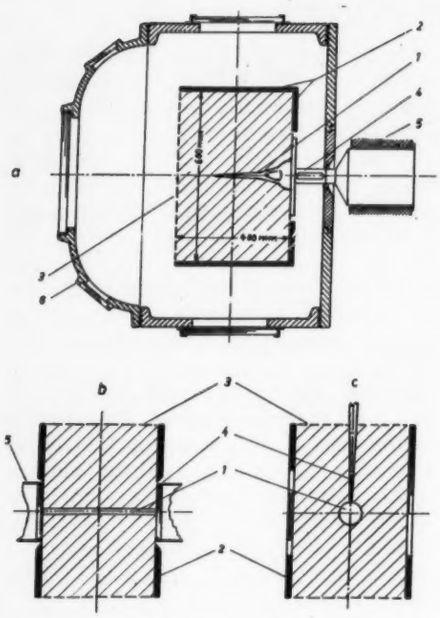


Fig. 10: Schematic presentation of how a test is conducted in the ATAR wind tunnel (cross-section through the air stream).

a) Half-model arrangement
b) Arrangement for two-dimensional flow
c) Arrangement for three-dimensional flow
1 Model — 4 Model fixture
2 Fixed flow boundary — 5 Balance fixture
3 Free jet boundary — 6 Test section

The heating of the air sucked through the tunnel is executed by means of previously-heated layers of gravel, [3] through which the air flows. This manner of reducing the relative air humidity is far from being as expensive as the reduction of the absolute air humidity by means of silica gel, for instance, a method frequently used in supersonic wind tunnels.

In order to augment the output capacity of the wind tunnel, in other words to reduce its operating costs, a hydraulic multi-component balance must form part of its equipment. The forces, the moments, the position of the model, and the Mach number are transmitted to a measuring desk where these values are represented as coordinates. In this way subjective errors are almost entirely precluded, and the research worker obtains, during the measuring period, a comprehensive picture of the results, thus enabling him to recognise major phenomena immediately and to continue the test accordingly.

[3] The layers of gravel form a heat accumulator which is analogous to the Ruths type. In view of its limited capacity, the temperature of the air flowing out sinks somewhat when the wind tunnel is in function. Since the density of the air ρ varies in inverse proportion with the absolute temperature T, and the sonic speed a proportionally with $\sqrt{T}$, the dynamic pressure

$$q = \frac{\rho}{2} \cdot v^2 = \frac{\rho}{2} M^2 a^2 \approx \frac{1}{2T} M^2 \sqrt{T}^2 \approx M^2$$

remains constant if the Mach number also remains constant, so that the interpretation of the measurements is not complicated thereby.

The flat, interchangeable walls of the test section enable various arrangements to be made for the tests (Fig. 10) and the installation of entire models, cylindrical models in a two-dimensional flow, and half-models, whereby a tunnel wall serves as " mirror " for the flow and the disturbing boundary layer of this reflecting wall is diverted upstream of the half-model. The half-model arrangement allows larger models (higher Reynolds' numbers) to be used, facilitates the laying of leads for measuring, the supply of fuels, and a fixing of the model which allows for no disturbance of the flow. The last-named advantage is of exceptional importance, especially at high subsonic velocities, in view of the sensitivity of this flow with regard to disturbances. A Schlieren camera with electric-arc illumination allows for an investigation of the density gradient fields around the model, even when half-models are used.

VII. *Developmental prospects*

As the dimensions continue to increase, the advantage of low accumulation costs, compared with the total costs, will continue to move to the fore, whilst the costs of the measuring installations, building, and so forth, increase only slightly for larger wind tunnels. In a similar way, the lower and more regular power consumption of accumulator-type wind tunnels, as compared with the higher and intermittent consumption of constructions without accumulation, is appreciated when the wind tunnels attain greater dimensions.

Small wind tunnels used to be used primarily for scientific research, but nowadays there is an increased need for big wind tunnels, not only for studying the aerodynamics of aircraft, but also for testing engines and their installation, and executing strength and vibration tests. The Junkers works, for instance, was about to complete a high-velocity wind tunnel featuring a test section of five square metres.

In order to lessen the expenses involved in the inevitably long and tedious job of flight-testing, the desire was expressed for wind tunnels sufficiently large to hold full-scale aircraft prior to sending them off on their first flight. Such wind tunnels cannot be constructed at reasonable cost without some form of accumulation, and moreover, they are not necessary. We have seen from experience that, with increasing dimensions, the test intervals become longer, and as the technique of measuring at high velocities progresses, the actual measuring period becomes shorter. All these circumstances speak in favour of wind tunnels with energy accumulation.

A design of wind tunnel working with a pulverised jet of water, now in development, seems to offer better prospects than the steam-driven type described above. Instead of being fed with water vapour, the ejector receives hot water from a pressure container ; thanks to a special design of ejector, it vaporises partially, simultaneously accelerating the water which has not vaporised. As theory shows, the ejector can be constructed and the initial pressure of the " liquid-fuel motor " chosen in such a way that the operating costs and the price of the accumulator simultaneously reach a minimum. In practice, this would have the effect of diminishing the operating costs compared with those of steam-driven wind tunnels, especially if use is made of the possibilities of recuperating, at the exit of the diffuser, the hot water of the air-vapour-water mixture, and returning it to the accumulator. However, the essential advantage is contained in the reduction in price of the accumulator by at least one fifth; for not only is the power absorbed by the wind tunnel lessened, but above all, this accumulator is put to a better purpose than the Ruths accumulator. Indeed, it can be filled entirely with water and emptied down to the last drop, whilst the Ruths accumulator, like any steam boiler, must have a steam dome, which is dependent on the pressure, and still contains a large quantity of water once it has been " emptied, " whereby its pressure is about equal to the working pressure of the ejector.

If we compare the wind tunnel shown in Fig. 2 with that now being developed, we can see that the costs of accumulation have been reduced to 1 to 2 per cent. (!) of the original high price. In this way, even the giant high-velocity wind tunnels are stripped of their Utopian character.

Moreover, this new type of wind tunnel works reliably even when put into what might be termed brutal service. Since it continuously sucks in fresh air from the atmosphere, it enables investigations to be carried out on engines, which require air for combustion purposes and eject gases or vapour. The installation can be enlarged upon, meaning that one can later branch on to it various simple tunnels for special research purposes, or simply increase the wind velocity at the penalty of the functioning period, or else increase this functioning period through a parallel coupling of a second accumulator.

The future will reveal the influence of the introduction of controlled atomic energy on aircraft development. Aerodynamic research will have to pave the way for this era, and wind tunnels will continue to contribute valuably in this respect.

Farmers' Flying Club

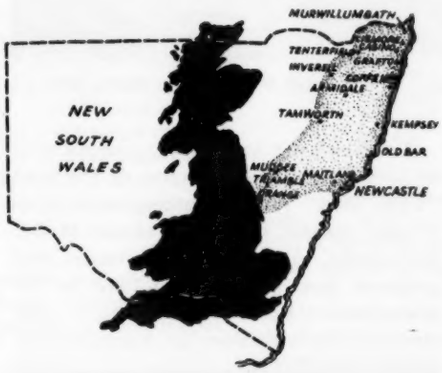
What must be the world's biggest aero club counts amongst its members a large proportion of sheep, cattle, dairy, wheat and sugar farmers living in New South Wales, Australia, in an area about the size of England. In 1949 the Newcastle Aero Club will celebrate its 21st birthday, firmly resolved to make the 750,000 people living in its area even more air-minded and to provide them with an opportunity of getting their flying experience. The club has already become an integral part of daily life in north-eastern New South Wales and is growing rapidly.

The city of Greater Newcastle is an industrial centre with a population of 150,000. Its aero club, however, is also the flying centre of the city's hinterland, which is mainly agricultural. The Newcastle Aero Club controls a network which takes sporting flying and other aerial services to enthusiasts in out-of-the-way parts of this vast Australian area.

The club has its own field and main headquarters at Newcastle and employs four of its seven full-time instructors for the special purpose of taking aircraft on training tours through the country. They work the area from fourteen local centres on a rotation basis. Apart from routine instruction and aircraft hire management, these officers are often called on for a quick air taxi job or to transport a sick patient from a hamlet many miles away from the nearest doctor. In each of these centres there is a small affiliated club.

The Newcastle Aero Club is controlled by a committee elected annually by the general membership. It employs a flight superintendent as a full-time manager, and he occupies a modern residence at the aerodrome located on the edge of the city limits. At the home field itself there are three full-time instructors, and members qualified as honorary instructors do much to help out training. Repairs, including major overhauls, engine changes and assemblies, are done in the Newcastle workshops by a full-time maintenance staff of eleven engineers and four apprentices.

The aero club's field is situated at Broadmeadow, about three miles by road from the heart of Greater Newcastle. Its 55-acre grass surface has runs up to 800 yards in two quarters and up to 450 yards in the other two. The main building is the big hangar, adjoining which is the roomy recreation hall, well furnished and equipped with an electric kitchen. One side of the hall is glassed in, facing the landing ground; it gives an excellent view of flying operations. The administrative block is in a big new brick building behind the hangar. It contains the flight offices, offices for instructors and the main office. The staff have their own dining and bathroom facilities.



The shaded area is the territory covered by the Newcastle Aero Club in New South Wales, Australia. Affiliated clubs, provided with Newcastle aircraft and instructors, operate from the towns marked. The area south of Newcastle is covered by the Royal New South Wales Aero Club from Sydney, 60 miles south of Newcastle. (Great Britain, shown black on the map, is on the same scale.)

Airminded farmers supply numerous pupils for the aero club's training activities through-

Three Avro "Cadet" trainers fly in formation over the industrial town of Newcastle.

Fleet of Newcastle Aero Club aircraft stationed at the club's headquarters aerodrome, Broadmeadow, just outside Newcastle, N.S.W.

Typical New South Wales country encountered by Newcastle Aero Club aircraft on cross-country flights. This is a watering resort on the Clarence River, Grafton, N.S.W.

out its vast "back-blocks," although young men and women from all walks of life make up the membership. In addition to farmers there are men who work in the heavy and coal industries, doctors, business and professional men. There are eight women pilots, the youngest of whom is seveneten.

Among the most recent country pupils to check out was the 18-year-old son of a sheep and cattle grazier at Moree, in the northwest of New Youth Wales. When the young farmer won his licence he bought a D.H. "Tiger Moth" from the club. Now, using a landing field alongside his homestead, he is engaging in a variety of communication tasks on the 20,000 acres that make up his family's backyard. He takes supplies to horse-riding boundary men. He flies passengers and mails to and from town 20 miles away, etc.

The Newcastle Aero Club often provides communications with outback parts on a charter basis. This is a recent and typical mission of the type: The manager of a pastoral company with extensive inland holdings chartered the club's "Hornet Moth" and a pilot to transport him on an aerial tour of inspection through fourteen different estates in various parts of Australia. The pilot and his passenger landed at scores of country homesteads, using the bare open paddocks or plains as landing fields and logging 54 hours and 4,300 miles.

The Newcastle Aero Club operates a total of 24 machines, namely, twelve de Havilland "Tiger Moth" primary trainers, seven Avro "Cadet" trainers, one D.H. "Hornet Moth," two Auster "Autocrats" whose frames were imported from England and fitted by the club with 130-H.P. D.H. "Gipsy Major" engines, one Wackett trainer (an Australian low-wing monoplane designed for the Royal Australian Air Force and fitted with a Warner "Scarab" radial engine), one D.H.84 "Dragon" twin-engined small transport and one Miles "Gemini" twin-engined personal aircraft. In addition there are a Link instrument flying trainer and about 20 D.H. "Tiger Moths" purchased from the Commonwealth Disposals Commission for spare parts. Compared with European conditions, flying charges are moderate: Avro "Cadets," the "Hornet Moth" and "Tiger Moths" cost £2.10s. per hour dual and £1.16s solo; the "Autocrats" cost £2.6s. and £2.8s. respectively; the D.H.84, which is used chiefly for training for commercial licences, costs £5 with an instructor and £3.10s. when hired by a member pilot. Although the club is now rationed by fuel restrictions to twelve hours flying time per member per month, instructors are averaging 600 hours each per year. The club's turnover in 1947 was £22,000.

Staff of Newcastle Aero Club at Broadmeadow, near Newcastle, N.S.W.

Operations are greatly helped by Government subsidies, comprising an annual maintenance subsidy of £1 per hour flown in the city and £1.10s per hour in the country; a licence subsidy (£70 in the city and £90 in the country) for every person trained to private pilot licence standard; a renewal subsidy for each renewed licence of any grading (£10 and £12.10s. respectively). Since 1935 the club has flown a total of 34,000 hours, including 11,000 hours since civil training recommenced in 1945. In 1947 a total of 5,149 hours was flown. Though there are five other big aero clubs in Australia, the Newcastle Aero Club's hours represent about a quarter of their combined total flying.

The Newcastle Aero Club was formally established in October, 1928, shortly after which the aerodrome at Broadmeadow was cleared and levelled. The club's first event was a flying display from the new field in December, 1929 (in the Australian summer). Flying training did not begin until April, 1934, when a club instructor, George McC. Littlejohn, came from Sydney to commence periodical visits. The club bought its first aircraft in October, 1934, a de Havilland "Moth Major." The following year it acquired the first "Tiger Moth" to fly in Australia as well as a B.A. "Swallow." Another "Moth Major" was bought in 1936 and three more aircraft in 1937.

The interesting system of "roving instructors" covering the vast hinterland of north-east New South Wales began in 1936, when the club branched out to make fortnightly visits to country outposts. This country service has been maintained and built up ever since. From October, 1939, to August, 1940, the club provided the initial training for the early wartime R.A.A.F. cadets. From then until the end of the war it was fully occupied with the production of aircraft components. As a result of this wartime work, it is now equipped with much-enlarged workshops.

The club will come of age in about ten months and intends vigorously to pursue its activity of increasing the degree of airmindedness in a country which, owing to its long distances and excellent flying weather, lends itself particularly well to the development of civil aviation.

The location of one of the affiliated "outback" aero-clubs: Tamworth Aerodrome, with the town of Tamworth in the background.

Type Designations

The type designation of an aircraft is like the name of a human being. It would be a simple matter if aircraft types had only Christian names and family names. Designations such as Lockheed "Shooting Star," de Havilland "Vampire," combined with the mark number (version) would be clear and adequate. Unfortunately, however, only a few aircraft have proper names ; the majority of types are known by numbers, preceded by characteristic letters. And this is where the difficulties begin, for these designations are made up in accordance with given rules ; and unknown rules arouse people's curiosity. It is seldom that anybody wants to know exactly why his name is Smith or Jones, but mysterious symbols and numbers, for instance those on an official form, are invariably deemed worthy of some explanation. This is precisely the case for the type designations of aircraft, which, furthermore, are made up in accordance with widely divergent rules.

United States.

The Americans, who, alongside the Germans, are well known for their penchant for systematic procedures, currently employ several systems for formulating the type designations of their aircraft :

1) U.S. Air Force designations;
2) U.S. Navy designations;
3) manufacturers' designations.

Additionally, many types, but by no means all, have one or more

4) general names (military or from the manufacturers) which have become officially recognised. For instance, the Lockheed Model 49, 649 and 749 transports, whether they are flying under civilian or military colours, are all known as "Constellations," whereas the military versions of the Douglas DC-3 are known in Europe as "Dakotas," and in the United States go under the names "Skytrain" and "Skytrooper."

The designations given to aircraft of the U.S. Air Force are extremely simple to understand. Letters which show the function of the aircraft are followed by a hyphen and a serial number. Subversions are differentiated either by several serial numbers (*e.g.* C-47 to C-53 for the Douglas DC-3) or by letters following the serial numbers (*e.g.* B-36A to B-36C for the Convair bomber) ; prototypes are preceded by an "X" (*e.g.* Convair XC-99) and aircraft of an experimental series are characterised by the letter "Y" (*e.g.* Northrop YB-49). During 1948 a number of the identification letters were modified, so that it will be profitable to draw up in tabular form the new and old identification letters, with their explanations.

Key to U.S.A.F. Identification Letters.

Function of Aircraft	Identification Letters New	Old
Amphibian	A	OA
Attacker	—	A
Bomber	B	B
Cargo	C	C
	(UC Utility Cargo)	(UC Utility Cargo)
Fighter	F	P
Glider	G	G
Helicopter	H	R
Liaison	L	L
Target and Drone	Q	Q
Reconnaissance	R	F
Search and Rescue	S	—
Trainer	T	AT (Advanced)
		BT (Basic)
		PT (Primary)
Special Research	X	XS

In order to avoid mistakes, it is best to add to the service designation the name of the manufacturer and the aircraft's general name if it has one :

Douglas C-47 "Skytrain" (or "Dakota")
Republic F-47 "Thunderbolt"
Lockheed TF-80 "Shooting Star" (Trainer Fighter)

The U.S. Navy designates its aircraft by an entirely different scheme. The initial identification letter refers to the function of the aircraft, the second letter indicates the manufacturer. Between the two letters is a number which indicates how many of this type have been built (does not appear in conjunction with the first type of a series) ; then follows a hyphen and the mark number of the basic type. For instance, the patrol aircraft of Lockheed Aircraft Corp. are :

PV-1 "Ventura" (1st constructional series of the Lockheed "Vega 37")
PV-2 "Harpoon" (2nd constructional series of the Lockheed "Vega 37")
P2V-1 "Neptune" (1st constructional series of the Lockheed 26)
P2V-2 "Neptune" (2nd constructional series of the Lockheed 26)

Like the U.S. Air Force, the U.S. Navy uses the prefixes "X" and "Y" to indicate prototypes or types of limited procurement for service trials.

The Navy also decided in 1948 to change its old series of identification letters indicating the function of aircraft. At the same time the letters referring to the manufacturers were modified a little, and suffixes added after the mark number in order to indicate the special version. As a result, numerous existing types have had to be renamed. It nevertheless remains to be seen whether such extensive changes will apply to the really old types, for it often happens that the designations have become as proven as the aircraft. Below is a list of the new and old identification letters used by the U.S. Navy.

1. Key to U.S. Navy Identification Letters.

Function of Aircraft	Identification Letters New	Old
Attacker	A	SB (Scout bomber)
		TB (Torpedo bomber)
Bomber	—	B
Fighter	F	F
Glider	G	—
Helicopter	H	H
	(HO Observation)	(HJ Utility)
	(HR Transport)	
Observation	O	O (Observation)
		S (Scout)
Patrol	P	P (Patrol)
		PB (Patrol bomber)
Trainer	T	N
Transport	R	R (Multi-engined)
	(RU Utility)	G (Single-engined)
		J (Utility)
		H (Ambulance)

2. U.S.N. Reference Letters for Manufacturers.

B Beech, Boeing
C Curtiss
D Douglas
E Edo, Piper
F Grumman
G Goodyear, Globe
H McDonnell (formerly D)
J North American
K Kaiser (Fleetwings Div.)
L Bell
M Glenn L. Martin
N Naval Aircraft Factory
O Lockheed (also V)
P Piasecki
Q Fairchild (formerly F)
R Ryan
S United Aircraft (Sikorsky Div.)
T Northrop
U United Aircraft (Chance-Vought)
V Lockheed (also O)
Y Consolidated Vultee

3. U.S.N. Suffixes for Special Versions.

A Amphibious version
B Special-armament version
C Carrier version of non-carrier aircraft
D Drone-control version
E Special electronic version
G Search and rescue version
H Hospital version
J Target-towing version
K Target-drone version
L Searchlight version
M Weather-reconnaissance version
N Night-operating version
P Photographic version
Q Countermeasures version
R Transport version
S Anti-submarine version
T Training version
U Utility version
W Special search version
Z Administrative version

For example, if the first series (1) of the "Skyraider" attack aircraft (A) manufactured by Douglas Aircraft Co. (D) is equipped so

as to be able to counteract radar (Q), it is known as the AD-1Q ; and if the second series (2) of the Lockheed (V) "Neptune" patrol aircraft (P) is fitted with anti-submarine armament (S), then it is known as the P2V-2S.

The fact that the U.S. Navy and the U.S. Air Force use different combinations of letters and numbers to designate the same aircraft does not, of course, make things easier to understand. And besides this, there are numerous cargo and utility aircraft serving both branches of the U.S. armed forces, as is shown by the following examples :

Manufacturers' Designation	General Name	U.S.A.F. Designation	U.S.N. Designation
Beech 18-S	"Expeditor"	UC-45	JRB
Curtiss CW-20	"Commando"	C-46	R5C
Douglas DC-3	"Skytrain" ("Dakota")	C-47	R4D
Douglas DC-3	"Skytrooper" ("Dakota")	C-49	R4D
Douglas DC-3	"Skytrooper" ("Dakota")	C-53	
Douglas DC-4	"Skymaster"	C-54	R5D

*

Great Britain.

As a rule the British prefer to give proper names to their aircraft. Alongside the unambiguous designations, ranging from the Airspeed "Ambassador" to the Westland "Wyvern," the factory designations (*e.g.* A.S. 57 for the "Ambassador" and W. 34 for the "Wyvern") are of secondary importance ; but the mark number is extremely important. Of the D.H. 98 "Mosquito," for example, there exist about a dozen different versions which are still in use. Mark numbers were formerly indicated by Roman numerals up to twenty, and afterwards by Arabic numerals ; since 1948 Arabic numerals are used exclusively. In order to indicate the function of the aircraft, it often happens that one or more letters are interposed between the general name and the mark number. For instance, the complete designation of a well-known de Havilland long-range reconnaissance aircraft is D.H. 98 "Mosquito" P.R. Mk. 34. Below is a list of these symbols and their explanations :

A.O.P.	Air Observation Post
B.	Bomber
F.	Fighter
F.B.	Fighter Bomber
Met.	Meteorological Reconnaissance
N.F.	Night Fighter
P.R.	Photographic Reconnaissance
T.	Trainer
T.F.	Torpedo Fighter
T.T.	Target Tug

Meanwhile, there are also several nameless types, which go either under their manufacturers' designations (A.W. 52, Bristol 171, etc.) or the Air Ministry specification numbers (Hawker N. 7/46, Heston A. 2/45, etc.). The majority of aircraft are characterised by the manufacturers' names and only few manufacturers use symbolic letters :

Airspeed	A.S.	General Aircraft Ltd.	G.A.L.
Armstrong-Whitworth ...	A.W.	Handley Page	H.P.
A.V. Roe & Co.	Avro	Miles	M.
Blackburn	B.	Percival	P.
De Havilland	D.H.	Saunders-Roe (Saro)	SR.
Elliotts of Newbury	EoN	Westland	W.

*

Western and Northern Europe.

It is only seldom that one finds general names for aircraft manufactured in Western and Northern Europe. As a rule, therefore, aircraft types go under their manufacturers' designations. Below are a number of symbolic abbreviations used by manufacturers :

FRANCE		ITALY	
SNCA du Centre (Aerocentre)	N.C.	Caproni	Ca.
SNCA du Nord	Nord	Cantieri Riuniti dell'Adriatico.....	Cant.
SNCA du Sud-Est	S.E.	Macchi.....	M.
SNCA du Sud-Ouest	S.O.	Piaggio	P.
Morane-Saulnier	M.S.	Soc. Aeronautica Italiana.	SAI
Soc. d'Etudes et de Constructions Aéro-Navales.	SECAN	Soc. Italiana Aeroplani Idrovolanti-Marchetti ..	S.M.
Société Industrielle pour l'Aéronautique	SIPA		

OTHER COUNTRIES

Spain	Aeronautica Industrial S.A..	AISA
Denmark	Kramme & Zeuthen (Skandinavisk Aero Industri). .	KZ
Sweden	Svenska Aeroplan A.B.	Saab

Firms not mentioned above use a part of their name in conjunction with the aircraft designation, as for instance Breda, Bréguet, Fairey, Fokker, and so forth. The following main trends may also be noted :

In France, only SNCA du Nord gives general names ("Goëland," "Noralpha," "Norazur," etc.) to the majority of its aircraft. Other manufacturers prefer numbers and only use general names for better-known types (*e.g.* S.E. 161 "Languedoc," S.O. 30 "Bellatrix," etc.). In recent years rather long numbers have been chosen, for example 2000, 3000, 6000, 7050, etc., though only the first three digits seem to have any real significance ; the last digit (a zero in the case of prototypes) is probably only to characterise the version.

In Italy, too, it is the practice to use numbers; and names are exceptional. It frequently happens that, in addition to the manufacturers, the designer is also characterised by a symbolic letter : G for Gabrielli (Fiat), C for Castoldi (Macchi), Z for Zappata (Cant, Breda), and so forth.

Swedish manufacturers use two-digit numbers and occasionally employ general names ("Scandia," "Safir"). The Swedish Air Force characterises each of its types with a functional letter and continuous serial numbers :

J for fighter (J 21R, J 29, etc.)	S for reconnaissance aircraft (S 18, etc.)
A for attack aircraft (A 21A, etc.)	B for bomber (B 18, etc.)
T for torpedo aircraft (T 18, etc.)	Sk for training aircraft (Sk 14, etc.)

*

Eastern Europe.

All aircraft factories in the Soviet Union and its satellite countries are State-controlled. Russian factories are simply numbered and those in Czechoslovakia, the only country in this bloc possessing a real aircraft industry, are mostly automobile firms and characterised by their geographical location (Čakovice Works, Chočen Works, Otrokoviče Works, Karlin Works, etc.).

In the absence of a general name, Soviet aircraft types are named after the constructor responsible for the design or copy, and allocated a mark number.

Russian Type Designations.

IL	Ilyushin	PE	Petlyakov
LA	Lavochkin	PO	Polikarpov
LAGG	Lavochkin, Gorbunov and Gudkov	UT	Uchebny Trenirovochny
		TU (ANT)	A.N. Tupolev
MIG	Mikoyan and Gurevich	YAK	Yakovlev

Czechoslovakian aircraft types, on the other hand, have retained their traditional family names, which are reminiscent of their capitalist predecessors :

Aero	Mraz
Avia	Praga
Letov	Zlin

These are supplemented by numbers and occasionally by general names such as "Sokol," etc.

*

Remaining Countries.

Among other countries, Canada uses both British and American principles : the Canadair DC-4M is known in the Royal Canadian Air Force as the C-54GM, whilst the DHC-1 manufactured by The de Havilland Aircraft of Canada is known as the "Chipmunk." Australia, Argentina, Brazil and Turkey use factory designations, these being abbreviated as follows :

Argentina	Instituto Aerotecnico	I.Ae.
Australia	The de Havilland Aircraft Pty.	DHA
Australia	Commonwealth Aircraft Corp. Pty.	C.A.
Brazil	Companhia Aeronautica Paulista	C.A.P.
Brazil	Companhia Nacional de Navegaçao Aérea	C.N.N.A.
Brazil	Instituto de Pesquisas Tecnologicas	I.P.T.
Canada	Canadian Car & Foundry Co..	C.C.F.
Canada	The de Havilland Aircraft of Canada.	DHC
Turkey	Nuri Demirag	Nu.D.
Turkey	Turk Hava Kurumu.	T.H.K.

This brings us to the end our description of the main systems of designating aircraft types throughout the world. Judging by previous experience, however, it is not at all improbable that the systems will, in part at least, be standardised or modified again.

Argentine Gales

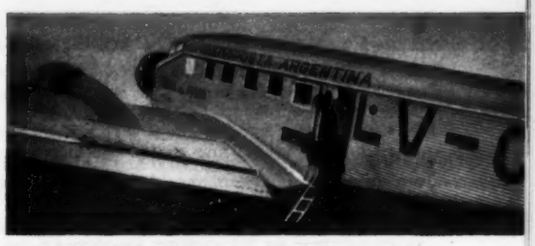
ARGENTINA RE-ORGANISES HER AIRLINES

Storm over Patagonia.

Every country glorifies its aeronautical pioneers. It is with justifiable pride that nations remember the men who flew the first mile, accomplished the first curve, or who courageously braved mountains and oceans.

The *Secretaria de Aeronautica de la Nacion*, the Argentine Secretariat for Air, did all these things by publishing a magnificent book in 1948, on Argentine aeronautical history : *La Aeronautica Nacional al Servicio del Pais** (National aviation serving the country). Despite its completeness, this book forgot one thing—to confirm a laurel wreath upon the unknown passenger, the courageous person who first entrusted his life to a scheduled commercial aircraft. We are at a loss to decide who showed the most courage, the pilot who sat at the controls and therefore had something to occupy his mind, or the patient passenger who in 1936 allowed himself to be transported by air from Bahia Blanca to San Julian in the Argentine province of Patagonia.

The oldest Argentine air carrier, Aeroposta Argentina, founded in the '20's, operated the Bahia Blanca — Rio Gallegos — Ushuaia (Tierra del Fuego) route with French "Latécoère 25" single-engined aircraft, which accommodated one pilot and four passengers. The latter came to know the countryside extremely well, for the traditional storm raging over the completely flat Pampas frequently attains 50 m.p.h. and more, and in those days forced the aircraft down to about 150 ft. There was no such thing as radio. On one of Aeroposta first flights, an aircraft had to circle around Comodore Rivadavia for two hours before it could come in to land, for as soon as the pilot tried to throttle the engine, the aircraft was blown out over the Atlantic. The actual landing was a story in itself. Six athletic men jumped on to the aircraft and stopped it from rolling further forwards. Three men held the struts and each wing tip in an energetic endeavour to prevent the machine from tipping over. The passenger then jammed his hat well down over his ears, clambered out of the cabin, and braced himself against the wind.



In 1936 Aeroposta Argentina operated with four-seater "Latécoère 25" single-engined aircraft, which were later replaced with three-engined Junkers Ju 52 transports.

Gale in Buenos Aires.

At the end of August, 1948, the Argentine Government formed a National Secretariat of Transportation which has direct control of the country's marine, rail and road transportation systems, and also—whether rightly or wrongly remains to be seen—the airlines, the administration of the latter being transferred to it from the Directorate-General of Civil Aviation at the Air Ministry. One should not confuse the airlines with general civil flying activities. The latter, involving private flying and pre-military training, etc., are still under the Air Ministry.

Let us keep to the airlines. There exist four carriers :

Aviacion del Litoral Fluvial Argentino, Sociedad Mixta (ALFA) ;
Aeroposta Argentina, Sociedad Mixta (Aeroposta) ;
Zonas Oeste y Norte de Aerolineas Argentinas, Sociedad Mixta (ZONDA) ;
Flota Aerea Mercante Argentina (FAMA).

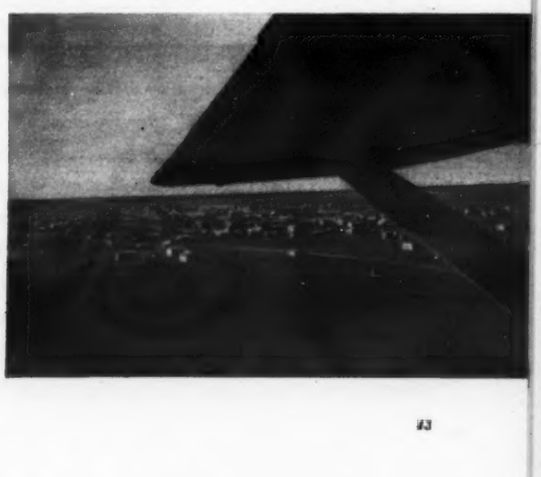
Apart from the re-organised Aeroposta concern, all are post-war organisations, which have hitherto operated at considerable loss. These four concerns, capitalised at 140,000,000 pesos, are estimated to have lost about 143,000,000 pesos in 1947, and the results for 1948 are expected to be around the same figure.

The most important of these companies is FAMA, at least half whose shares are owned by the State. In order of importance, the others are ZONDA, Aeroposta and ALFA.

As the national overseas carrier, FAMA was built up as the representative Argentine airline. It has already operated a number of overseas routes, though with thoroughly unsuitable British airliners, Avro "Yorks" and Avro "Lancastrians."

It would seem that Dr. Santiago J.A. Diaz Bialet, hitherto President of FAMA, has had

Landing at San Julian in 1936. Six men had to tame the aircraft. Settlement in the Argentine Pampas.



* Cf. Book Review in Vol. III, N°. 11, p. 641.

Air view of the Cordilleras de los Andes, the mountainous barrier separating Argentina and Chile, with peaks rising to well over 20,000 ft.

A 50-m.p.h. gale roars through the streets of Rio Gallegos in Patagonia.

a feeling for some time that something was wrong with his company. At all events, he decided to buy new equipment, and ordered, as an addition to his existing Douglas DC-4s, six new DC-6s and five twin-engined "Convair-Liners." These orders were his swan song. He had his aircraft all right, but he had forgotten about the crews, ground personnel and technical staff. The six DC-6s were sent from Santa Monica to Buenos Aires' main airport, Moron. The five "Convair-Liners" have fortunately not yet been delivered and may later be given either to ZONDA alone, or jointly to ZONDA and Aeroposta, for the operation of South American routes.

Thus it came that in August Dr. Bialet was replaced as President of FAMA by Captain Alvaro Carlos Alzogaray. The latter is faced with the task of bringing the derailed FAMA carriage back on to the right track.

To this end he is cutting the company's services to a minimum in order to permit a thorough study of the plans for the future. And these plans are ambitious ones: after next spring, he intends operating thrice-weekly services to New York with the DC-4s and similarly-scheduled trips to Europe with the DC-6s. If he succeeds in realising this plan, then the Argentine flag will be flown on other Continents. The young Latin American Republic feels, on the grounds of its riches, its world significance and international relations, that it is justified and even duty-bound in doing this.

As far as the other companies are concerned, the only person to remain in office was Jorge E. Souvillé, as President of ZONDA.

Captain Alvaro C. Alzogaray, who has been entrusted with the re-organisation of FAMA, Argentina's international airline.

Major Jorge E. Souvillé, President of ZONDA, was the only top Argentine airline executive whom the gale through civil aviation officialdom did not blow off his feet.

A certain personal union between ZONDA and FAMA is discernible from the fact that Captain Alzogaray, formerly Director-General of ZONDA, has retained this position despite his elevation to the Presidency of FAMA. The former President of Aeroposta, Perez, has been replaced by Juan Bautista Almandoz, and a similar reshuffle has transpired in ALFA, where Comodore Carbia has been replaced as President by Vice-Comodore Juan F. Fabri.

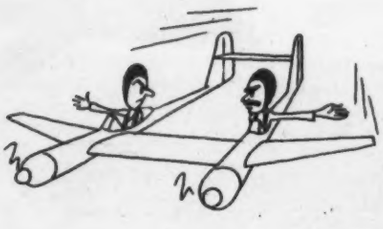
To quote Argentine aviation circles, a gale has swept the country's civil aviation. Men went, and new men came.

Argentina wishes to have a national aviation set-up, and one which does honour to the country. These changes among top executives are evidently in order to meet this end.

Before World War II Argentine civil aviation was primarily in foreign hands—apart from Aeroposta. Air France, the Condor-Syndikat (a sort of subsidiary of the German Lufthansa), Pan American Airways or their subsidiary Pan American-Grace Airways, held the field. The Lufthansa's influence has disappeared, that of Air France is dropping into the background owing to war events, and that of Pan American Airways on the up-grade.

Argentine civil aviation is by no means hostile to foreigners. Landing rights have been granted to Scandinavian Airlines System and K.L.M. Royal Dutch Airlines just as they have been given to the North Americans and . . . British. For immediately after the war, the British, through the medium of British South American Airways Corporation, endeavoured to obtain a sound footing in Argentine civil aviation from both the standpoints of traffic and flying equipment. In this connection, however, they committed two errors: they themselves flew second-class aircraft, and they sold to the Argentines—what may have been a still greater mistake—the same second-class aircraft as they themselves used: Avro "Lancastrians" and Avro "Yorks." These aircraft have given the Argentines a rough time.

Hence the re-organisation of flying equipment and, last but not least, the changes in the management of Argentine civil aviation.



The Air Hostess Told Us...

To Each his own Air Lift.

The world, Esmeralda says, has made a new discovery, the Air Lift. Air Lifts are the modern rage, like pole-sitting or tree-squatting or blintz-eating of by-gone times, before all the trees were felled for armament purposes, when poles were available without nine-month delivery delays, and food was plentiful almost everywhere. Our Favourite Air Hostess says she dreamed that all the airlines had closed shop and left the field—or the air—to the air lifts. Dismayed at such a disruption in the most modern, most comfortable, most reliable, most rapid, most expensive and most publicised travel system, she soon found that she could travel virtually around the world by air lift, practically gratis, since the various governments—and the poor taxpayer—foot the bills for almost all the lifts.

She dreamed she left New York for Bermuda. Since Bermuda is running short of meat because of a dockers' strike, she had to disguise herself as a 110-pound piece of frozen meat—a trick she found rather difficult, especially the "frozen" part—as air carriers are lifting large quantities of meat to the British resort colony, but no extra passengers. When she found she couldn't get beyond Bermuda, she returned to New York and took the Atlantic Air Lift (also due to the dock strike) to Paris—this time disguised as surface mail going by air without surcharge.

In Paris, Esmeralda dreamed, she nearly got stuck again ; the air lift seemed to have run into a dead end. On the Champs Elysées she overheard two men talking about their own private air lift. I am Esmeralda, she interrupted ; will you take me along ? *Oui, certainement*, they said.

In night and rain she was driven to an abandoned airfield some miles outside Paris, and so it came that our Favourite Air Hostess discovered the Racketeers' Private Air Lift which, equipped with about 50 twin-engined Douglas transports, operated from a number of disused aerodromes in France and the French Zone of Occupation to places beyond the Iron Curtain. This air lift had nothing in common with the others. Instead of costing money, it operated for filthy lucre. Hundreds of road trucks brought the goods from the British and American Zones to the airfields, and off went the machines—exactly where to, nobody was able to find out. As Esmeralda's aircraft was landing at another "disused field" near Strasbourg, together with several other transports, they were attacked by French paratroops on manoeuvres. She did not get hurt, however, as she was travelling as a piece of black-market cheese-cake, although several black eyes resulted in other quarters. So fierce was the fighting that Esmeralda woke up, just in time to hear the radio announce that the American, British and French Authorities had denied the existence of this racket. Which assured her that she had really been dreaming, despite a recent headline story in the Stockholm "Aftonbladet."

Contentedly, she dozed off again, to find herself hitch-hiking to Frankfurt. She ended up in a mighty "Skymaster" disguised as a sack of coal and was happy she wasn't in one of those decrepit wrecks operating on some sections of the Air Lift. A few Russian fighters made passes at her, as if they knew that she was Esmeralda and not just a lump of coal, and after the usual thirty-seven protests had been collected by the Russians, she was shovelled out of the aircraft. She fell so badly that she nearly woke up again, especially as she discovered that in Berlin the lift had petered out once more. She bought a fistful of Ostmarks for a dollar and took the Czech aircraft to Prague. There, she found, another air lift was functioning. In a surplus C-69 "Constellation" she travelled on Israel's air lift to Palestine. Towards the end of her dream, which by now had degenerated into a nightmare, she was waiting to go to Cairo by a United Nations aircraft. There she was hoping to join one of several DP air lifts to Australia. On the way she wanted to try out a local lift in India or Pakistan, and in Australia she could have flown from Melbourne to Perth with a load of bread, as the bakers of the latter city are on strike. However, she woke up and was glad to be home in bed.

Serious gaps, she now reflects, still exist in this air lift business. The Soviets, for example, have consistently refused to join the system and even disapprove of the air lift to Berlin. The Western Powers, too, have not yet realised how popular a round-the-world air lift could be. If they had, they would quickly establish the missing links between Australia and Hawaii or Alaska, from which points efficient air lifts operate to the USA, as a result of another couple of maritime strikes. The Russians, on the other hand, could connect Berlin with places in Communist-held China, which are temporarily being supplied by air lifts from Kuomintang Nanking, no doubt until the pilots of the transports decide to sell their aircraft to the highest bidder or to the local war lord who happens to be winning in the particular area.

All these individual air lifts, Esmeralda opines, ought to be integrated into one gigantic globe-girdling air lift, financed by the world's taxpayers for the purpose of providing other taxpayers with free transportation to promote international understanding and everything else the United Nations would like to stand for. If an International Air Lift Organisation (IALO) came into being, goods could be kept moving round the world without interruption. You could ship a gift parcel by jet-propelled aircraft westwards from New York or any other place and, provided the aircraft flew fast enough on a straight course, you could collect it again the same evening. This would be of great service to mothers-in-law and others who don't expect a lot of presents for Christmas. Chief pilot of the round-the-world IALO would obviously be one Santiago Germano, of Argentina, who qualified for the job in Buenos Aires on November 5th by looping-the-loop 960 times in two hours fifty-two minutes, beating the previous "record" of 630 loops.

Esmeralda says she is feeling quite loopy as a result of all this heavy thinking and will now try to get some more sleep, without dreams.

Bl.

Take-Off Rockets

High take-off weight is a salient characteristic of each of the landplanes of the U.S. Navy and Air Force depicted here : the four-engined Lockheed "Constitution" giant transport for 180 persons weighs 184,000 lbs. when fully loaded, and counts among the six largest landplanes in the world ; the Boeing XB-47 "Stratojet" jet bomber grosses 125,000 lbs. and has a wing loading of about 89 lbs./sq. ft. ; and finally, the Lockheed P2V "Neptune" twin-engined long-range patrol bomber features a normal take-off weight of 60,000 lbs., but took-off for its famous 11,236-mile record non-stop flight at a gross weight of 85,000 lbs. and with a wing loading of 85 lbs./sq.ft.

When such great weights have to be accelerated at the take-off, and the take-off speed has to suffer the setback of such high wing loadings, a shortening of the take-off run by means of additional thrust can, under certain operational conditions (runway too short, air temperature unfavourable, and so on), determine whether a safe take-off is possible or not.

Flight tests conducted on the "Constitution" with six JATO (Jet-Assisted Take-Off) rockets, which burn for approximately fifteen seconds and each deliver a 1,000 lbs. thrust (together 6,000 lbs.), thus roughly equal to the 3,500 H.P. from one of the aircraft's four Pratt & Whitney "Wasp Major" engines, have shown that the take-off run can be shortened by almost one quarter and the initial climbing speed improved considerably. Moreover, reserve take-off rockets offer additional protection against the hazard of engine failure at take-off, an occurrence which could have disastrous consequences under such extreme conditions. For the experimental flights with the "Constitution," three JATO bottles were located in compartments inside the wing on each side of the fuselage behind the inboard engines and above the flaps. The smoke trail was made to pass well under the tail surface so as to cause no buffeting and no influence on controllability.

Whilst JATO units reveal themselves as exceptionally effective and advantageous in the

The U.S. Navy's giant "Constitution" transport for 180 persons is lifted into the air by six JATO rockets and 14,200 H.P. engine power.

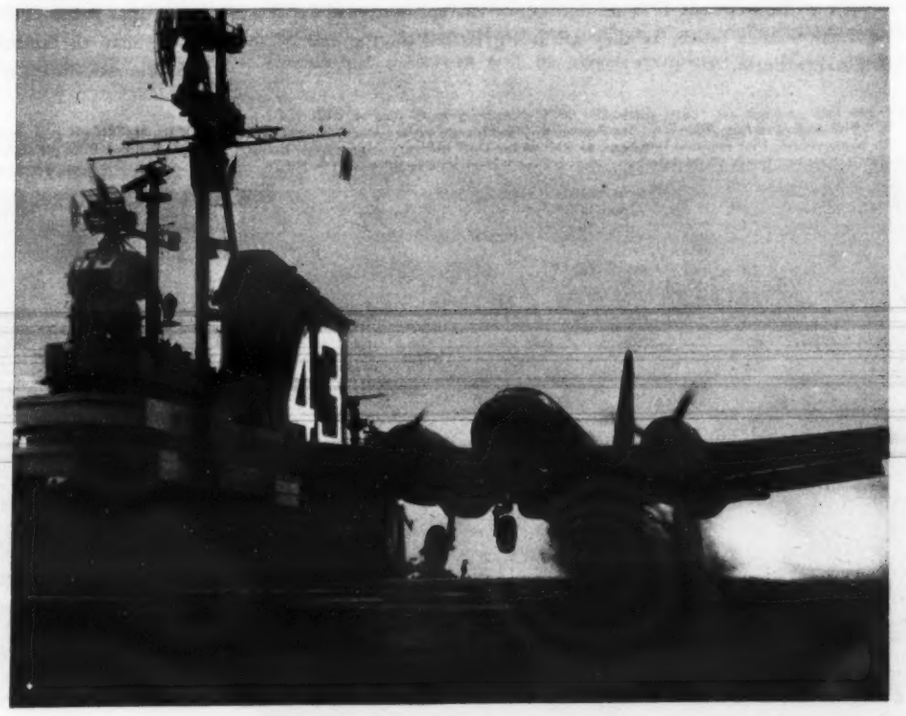
case of piston-engined aircraft, they can, under special conditions, be indispensable to highly-loaded jet aircraft. The turbo-jet differs from the propeller engine by its pronounced lack of power during slow flight, as there is only a jet stream of approximately constant thrust power and no controllable-pitch propeller to enable engine torque and r.p.m. to be converted fully into propulsive power. The high-speed Boeing XB-47 "Stratojet" bomber is consequently equipped with eighteen take-off rockets, built into the fuselage, which add 18,000 lbs. to the static thrust of 24,000 lbs. furnished by the aircraft's six General Electric J-35 turbo-jets ; these can also be ignited if the aircraft has to go round again as a result of a faulty approach to the runway. Numerical data on the take-off runs and climbing speeds attained, are not given, but judging from the accompanying photo they ought to be rather impressive.

At the beginning of last November the U.S. Navy conducted carrier take-off tests with highly-loaded patrol bombers. The photo showing the Lockheed P2V "Neptune" leaving the deck of the 45,000-ton aircraft carrier "Coral Sea" is the first evidence released on these activities. It is stated that two of these aircraft, doubtlessly the largest ever to be launched from a carrier deck, were fitted with eight JATO rockets (presumably each furnishing 1,000 lbs. thrust) attached to the fuselage. Commander T.T. Davies, U.S.N., famed for his command of the "Truculent Turtle," the P2V "Neptune" which broke the world's non-stop flight record two years ago, took one of these aircraft off the deck of the "Coral Sea." He was airborne after a half-deck run, but landed on a coastal airfield as his aircraft was not fitted with arrester hooks for deck landings. It is certain that deck landings will be carried out in the future; and as soon as the Navy's new 65,000-ton aircraft carrier has been built and put into service, the dimensions and take-off weights of carrier-borne aircraft will increase. The keel of this giant flush-decked carrier has already been laid. At present known under the designation CVA-58, it should do thirty-three knots and its 1,030-foot-long flight deck will constitute a floating base for aircraft of "well over 100,000 lbs."

At all events it is now sure that aircraft carriers will not only remain a means of tactical sea warfare, but can also serve as instruments of strategic air warfare. Due to the aircraft carrier—and the modern methods of assisted take-off—bombers of a sea power, during attacks on the strategic centres of a land power, are no longer tied to land bases... a circumstance which will not omit to leave its mark on power politics.

Eighteen JATO rockets built into the fuselage of the Boeing XB-47 "Stratojet," the newest high-speed bomber of the U.S. Air Force, increase forward propulsion by 74 per cent.

The largest aircraft ever to take-off from an aircraft carrier : a Lockheed P2V "Neptune," aided by eight take-off rockets, leaves the flight deck of the 45,000-ton aircraft carrier U.S.S. "Coral Sea."



Economic Aspects

The U. S. Aircraft Industry

The election results are unlikely to have any disturbing effect on the U.S. aviation industry. President Truman's administration is believed just as likely, if not more so, to continue an agressive air power policy as the Dewey government would have done.

By the time these lines are in print, the Reconstruction Finance Corporation will have issued the report so anxiously awaited by the airline industry. Recommendations for airline aid are anticipated, and it is likely that the R.F.C. report will contain a recommendation for the formation of an equipment holding company. If it does, Floyd Odlum's equipment pool proposal may receive the blessing of a loan from the R.F.C. Mr. Odlum is Chairman of Consolidated Vultee Aircraft Corp. and also President of Atlas Corporation.

The coming year is the first in which the United States aircraft manufacturing industry will really reflect the impact of the drive to rebuild the country's military air strength.

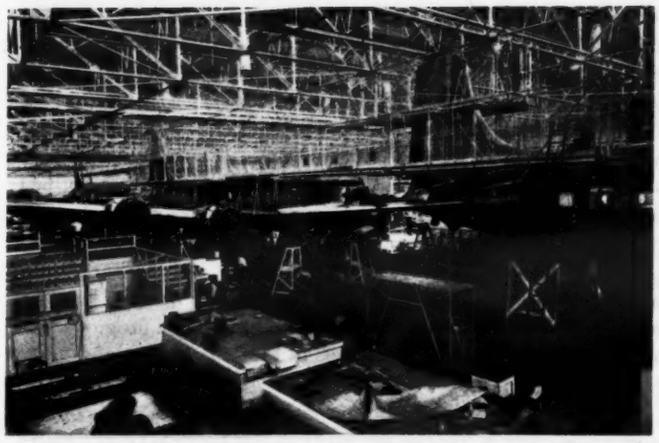
So far, about all that has happened since Congress approved appropriations of $3,200,000,000 for new aircraft procurement late last spring, has been in planning and tooling. The major portion of this money is still in the Government coffers. Aircraft delivered during the last half of 1948 were against contracts awarded under previous appropriations. Even new orders for aircraft already in production —such as the Republic F-84 jet fighter, for example—have not affected production rates much, as they are being tacked on the end of the original business.

As regards aircraft manufacturing, this year ahead will also be remarkable for the end of the commercial aviation business, at least for commercial transports, and a small production of personal aircraft. But air transport deliveries to the airline companies will be just about finished, with a few exceptions, by mid-year. This hiatus in airline production, however, should prove a source of satisfaction rather than regret for the aircraft company stockholder. For since the end of World War II the aircraft manufacturers who competed for the commercial transport market piled up losses amounting to around $70,000,000. Although this not inconsiderable sum has been reduced somewhat by tax credits, and may suffer further cuts, it has made commercial aircraft building highly unpopular.

It is the consensus of aircraft manufacturers that, with the exception of the few replacements for the obsolescent Douglas DC-3, there will not be a real revival of commercial transport buying for five or six years. The airlines of the United States are having trouble digesting the post-war transports they have already bought. Most airlines are not in too good financial state, and they are in no position to sponsor new designs. The aircraft manufacturers themselves are extremely reluctant to tie up the twenty to thirty million dollars necessary for developing a brand-new transport. It is no secret that they will rely on the engineering experience derived from military orders to help them with their next models, which will probably be jet-powered. This means that the aircraft manufacturers will not have designs ready any sooner than the airlines are prepared to order them. Although one U.S. domestic airline is talking about a jet airliner for short and medium

BOEING in full swing. The U.S. Air Force has placed large orders for B-50 and B-54 (in background) four-engined bombers, as well as for C-97 military transports. Boeing also has orders for B-47 jet bombers and civilian "Stratocruisers."

NORTH AMERICAN has received large production orders for B-45 jet bombers (shown in photo) and F-86 jet fighters.



DOUGLAS, once it has terminated its DC-6 business, will turn to production of the big C-124 transport and aircraft for the U.S. Navy ("Skyraider," etc.).

CONSOLIDATED VULTEE is still building twin-engined "Convair-Liner" transports, and has now received a firm order for a military version of this aircraft.

hauls, Captain Eddie Rickenbacker, President of Eastern Air Lines, will probably have to wait a good number of years before this project is realised. The British have developed a jet transport or two, but it is not considered probable that American air carriers will be much interested.

*

Surveying their enhanced prospects, U.S. aircraft manufacturers are still troubled by the profits limitation outlook. The appropriations act of 1948, which provided the money for aircraft building, also made it mandatory that all aircraft contracts be subject to government renegotiation. Sub-contractors, too, fall under this requirement. This complicates an accounting picture already made complex by the Air Force policy of redetermining prices (either up or down) on completion of contracts, and the existing Vinson-Trammell Act, which limits profits on Navy contracts. But the concensus of aircraft manufacturers, nevertheless, is that a return of four to seven per cent. is not unlikely, after taxes, on gross business.

There are some other minor difficulties ahead, such as the shortage of junior grade engineers and gaps in certain grades of skilled machinists. Some manufacturers also fear that costs are rising so rapidly that appropriations money will run out before contracts are completed. By and large, however, the outlook is reasonably optimistic.

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With commercial business largely a thing of the past, what are the prospects facing some of the larger manufacturing units ?

Boeing Airplane Co. has the lion's share of the bomber contracts, and the largest backlog (over $450,000,000) of any company in the business. The B-50 and B-54 bombers, although powered with reciprocating engines, are the backbone of Air Force bomber strength for several years to come. Boeing also has a good-sized contract for its B-47 jet bombers. The company's earnings in 1949 should be somewhat better than in 1948, when strikes hampered production. Output in 1949 will show a considerable gain, but not until 1950 will full-scale production under the new programme be reached. Boeing may lose a little money on its commercial "Stratocruiser" business, but this should not prevent an improved earnings showing in 1949.

North American Aviation, Inc., with more than $400,000,000 worth of orders on hand, is the second largest contract holder. The company has top-notch production and management records, and stands to increase its earnings in the present fiscal year over those for the fiscal period which ended on September 30th, 1948. The company's B-45 jet bomber contract is the largest in the country, and the F-86 jet fighter contract is also the Air Force's largest now outstanding. Like Boeing, North American will not reach peak production until 1950.

Douglas Aircraft Co., pre-war leader of commercial aircraft manufacturing, has a backlog of about $260,000,000, mostly in military orders. The company has just about completed its commercial DC-6 business, although it hopes to sell some cargo versions of this airliner. The company's management was disappointed over the failure of the Air Force to order substantial quantities of transports despite the lesson of the Berlin air-lift. Douglas has a substantial Navy order now in active production, and next year will swing into production of the big C-124 transport for the Air Force. Last year (1948) Douglas nearly earned its $5 dividend per share, and should equal or surpass this showing in 1949. But the company needs more transport orders to continue this earnings and production rate after 1950.

Consolidated Vultee Aircraft Corp. took a bad financial buffeting during the past two years from its post-war commercial transport, the twin engined "Convair-Liner." But most of these losses are now behind it, and prospects are considerably improved. The 1947 and 1948 losses, in the first place, will provide tax credits rendering the company practically free from Federal income tax liability for the next two years. Consolidated has close to $200,000,000 worth of business on the books, mostly military and much of it potentially quite profitable. Commercial deliveries will be about completed by May, although

LOCKHEED is still busy producing F-80 "Shooting Star" jet fighters, and the P2V "Neptune" long-range patrol bomber is also on the company's programme.

NORTHROP has received an Air Force contract for its B-49 "Flying Wing" bomber, thirty units of which are being built under sub-contract by Consolidated Vultee at the latter's Fort Worth plant in Texas. The experimental model shown here is in Northrop's workshop.

additional orders are being sought; and, furthermore, the company is now in possession of its first firm orders for a military version of its twin-engined transport. Consolidated is also building the big B-49 flying-wing jet bomber for Northrop Aircraft, Inc., under sub-contract and, like virtually all major aircraft manufacturers, has several experimental designs under construction or already flying. Earnings prospects for 1949 are much improved, and the management expects good results for the next two years at least.

Lockheed Aircraft Corp., like Douglas, would also be glad to see the Air Force order more transports, namely its "Constellation." But the company has a backlog of about $200,000,000, and a steady production rate is promised for the next 18 months to two years. Big production items are the F-80 jet fighter, of which a trainer version is also on order, and the Navy's long range patrol bomber, the P2V "Neptune," known as the "Truculent Turtle" type.

Northrop Aircraft, Inc., has made a good deal of progress since the end of the war. Although the company produced some night fighters during the war, and has a good output record, in the past it has been regarded as principally an engineering firm. Now, the Northrop "Flying Wing" has been accepted by the Air Force. The company has also developed a three-engined utility military transport, suitable for use on small airfields, and is building a number of these for the Air Force. Prospects at this writing are very good for the F-89 all-weather fighter, and may result in a substantial production contract. Backlog orders, including the jet bomber contract which Consolidated is executing under sub-contract, amount to over $100,000,000, and earnings prospects for 1949 indicate somewhat better results than the moderate return for 1948.

Grumman Aircraft Engineering Corp., the East Coast firm specialising in Naval flying equipment, has close to $150,000,000 worth of business, mostly in Navy jet fighters. With an excellent reputation for production and management, the company stands to continue or improve already good earnings.

Republic Aviation Corp., Grumman's Long Island neighbour, is working on close to $80,000,000 worth of Air Force F-84 jet fighters. Republic already has achieved a high production rate and should maintain its present fairly good earnings rate through 1949 and into 1950.

Fairchild Engine & Airplane Corp. has a $80,000,000 backlog, and should maintain its moderately profitable operation for a least a year or two ahead.

The Glenn L. Martin Co. has upwards of $110,000,000 in backlog orders, and although hurt financially by its commercial aircraft project (the twin-engined Model 2-0-2), is on the mend. Its prospects, however, are not as bright as for some of the others.

United Aircraft Corp., builder of both aircraft and engines, with the latter commodity predominating, should be able to maintain its good earnings rate right along. The company's sales volume amounts to nearly $200,000,000 annually.

Curtiss-Wright Corp., has formally denied reports to the effect that it is abandoning the manufacture of aircraft following cancellation of an Air Force contract of $80,000,000 for F-87 long-range jet fighters. The company is continuing a fair-sized engine business, in reciprocating and gas-turbine designs, and should maintain a small profit showing again in 1949.

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There is no doubt that the situation has improved considerably. The U.S. aircraft industry is again moving towards a period of improved earnings, having largely written off the unlucky attempt to re-establish a profitable market for commercial airliners.

Only a year ago this industry was struggling to keep its head above water. Company executives were urgently pleading for contracts from the airline companies, despite the difficulties and expense involved in their realisation. The re-armament programme was evolved, the State stepped into the breach, and the industry is well on its feet... being even stronger than in 1940, when it started to build up the air strength of the British, the French and the United States. There are no severe problems of material supply, and plant facilities are adequate, including those owned by the Government. No major financing will be needed to handle the augmented manufacturing programme of the next several years.

The principal difficulties presently confronting the industry are: a scarcity of junior engineers; a lag in the delivery of the newer types of jet engine, which in turn delays completion of new aircraft; maldistribution of orders which has neglected makers of transport aircraft in favour of new-type bombers and fighters; and a tendency towards limitation of profits through renegotiation in line with the announced policies of the re-vitalised Truman Administration.

But despite these handicaps, aircraft manufacturing promises to be one of the strongest segments of the American economy for at least several years to come.

Frederick Peters, New York.

UNITED AIRCRAFT CORPORATION, manufacturer of aircraft engines (Pratt & Whitney), propellers (Hamilton Standard), helicopters (Sikorsky Division) and aircraft (Chance Vought), has plenty of business on hand. This photo shows the engine plant at East Hartford, Connecticut.

Official Bulletin of the F.A.I.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE, PARIS

The International Commission of Aerial Touring of the F.A.I. met in Paris from September 27th to 28th, 1948.

Among other things, the Commission studied a proposal put forward by the Royal Aero Club of Egypt, suggesting the general introduction of the system of making fuels exempt from customs duty, a system which is already in force for private aircraft in a number of countries. However, it does not appear possible, for the time being, to obtain further facilities in this connection.

The Commission approved a suggestion by the Aero Club of France concerning the universal recognition of national certificates of airworthiness, and expressed the desire that "the various national aero clubs should impress upon their respective governments the considerable interest underlying the conclusion of bilateral agreements for mutual recognition of national certificates of airworthiness."

A similar desire was expressed in connection with the general recognition of private pilots' licences.

The aero clubs of Great Britain, France and the Netherlands approved the re-establishment of the advantages accorded before the war to private flyers possessing an identity card issued by their national aero club : exemption from landing and take-off fees at certain airfields and the right to free hangar space during forty-eight hours. These advantages were the result of agreements between the separate national aero clubs, who applied them on a basis of reciprocity. Since general re-establishment of the card is not yet possible, the Commission recommended the conclusion of bilateral agreements between the national aero clubs, valid until such time as re-establishment of the pre-war card is again feasible.

Acting on a proposal put forward by the Royal Aero Club of the Netherlands, the Commission recommended the establishment of a touring office by each aero club.

The Commission expressed the desire that "the F.A.I. should contact ICAO with a view to overruling the formality, ordered by certain ICAO member countries, requiring that private flyers first obtain permission before they can land in a foreign country. Entry and occasional transit flight, with or without stop, should be authorised among all ICAO member countries as far as private aircraft are concerned."

The Commission furthermore recommended that the F.A.I. contact ICAO in order to ask this organisation to establish a standard and simplified document furnishing all information on the formalities ordered by the various national authorities in connection with the entry and departure of private aircraft and private pilots. This document should replace the numerous forms and questionnaires existing at present.

RECORDS HOMOLOGATED BY THE F.A.I.

International Records

Class D (Sailplanes) — 2nd Category.

Altitude above Point of Departure (France) :

Messrs. Guy Rousselet and Léon Faivre
"Kranich" two-seater sailplane, No. 3
St. Auban sur Durance
September 21st, 1948 : *6,780 metres.*

Women's Records.
Class D — 1st Category.

Duration (France) :

Miss Choisnet
Arsenal Air-100 sailplane, No. 5
Romanin les Alpilles (Bouches-du-Rhône)
October 19th-20th, 1948 : *28 hrs. 2 min.*

Book Reviews

Principles of Servomechanisms. By Gordon S. Brown and Donald P. Campbell. John Wiley & Sons, Inc., New York ; and Chapman & Hall, Ltd., London ; 1948.

The authors, both professors of electrical engineering at the Massachusetts Institute of Technology, present in an extensive and purely theoretical form, the design principles underlying electronic, hydraulic and mechanical mechanisms, as well as combined servomechanisms or closed-loop control systems in general. The weight is on synthesis rather than analysis, the problem being approached as one of dynamics rather than as a study of only the static characteristics of components. The book will be appreciated primarily by scientists and specialised engineers who have realised the increasing importance being attached to the domain of servomechanisms, or by senior university students wishing to specialise in this field. The aeronautical engineer, whose interests are rather more general, is surprised at the vast amount of mathematical knowledge necessary for comprehension of this all-important field of aircraft construction. Four hundred pages include numerous diagrams, tables, problems for student exercise, a bibliography of American and English literature, and an index. *Ri.*

Autogiros och Helikoptrar. — By N.O. Sefeldt. Published by A.-B. Allhems Förlag, Malmö, 1948.

This book on "modern magic carpets," describing systematically and almost without omission all rotary-wing designs from Leonardo da Vinci to the latest world speed record of 124.3 m.p.h. set up with the Fairy "Gyrodyne," constitutes Volume IX of an aeronautical series published by Allhems. About 170 illustrations enable the reader to acquaint himself in detail with the historical and modern details of this latest transport medium. Data on weights, performance, etc. are easy to consult, and the author has not omitted to give in simplified and easily understandable form a number of theoretical principles, such as lift, drag, torque compensation, gyroscopic behaviour, cyclic pitch change, autorotation, stability, and so on. The value of the book is further enhanced by descriptions and illustrations of the less known rotary-wing aircraft of Cierva, Focke, Dobblhoff, Pentecost, etc. Naturally, civilian helicopters take up the most space, notably the Bell 47B, which is now being introduced on a fairly wide scale in Sweden.

The author of this book of about one hundred pages, N.O. Sefeldt, is an aeronautical engineer with a vast amount of practical experience. Pilot since 1933 and Swedish Air Force instructor since 1936, he is one of the few European pilots who went through the monitor's course at the Bell piloting school and is therefore able to train helicopter pilots.

This exceedingly valuable book deserves to be translated into other languages in order that it may find a wider circle of readers. (Swedish.) *Ri.*

The Month in Review

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AVIATION POLITICS

● A bilateral civil aviation agreement concluded between Holland and Argentina permits KLM Royal Dutch Airlines to extend its South American service from Montevideo to Buenos Aires, and further on to Chile; and authorises Argentina to operate air services to Amsterdam.

● The Governments of India and Ceylon have concluded a draft civil aviation agreement. Negotiations between Italy and Portugal aim at the conclusion of a bilateral civil aviation agreement. Negotiations for a bilateral civil aviation agreement between the U.S.A. and Peru reached an impasse.

● A recently-concluded Anglo-Egyptian civil aviation agreement contains a reserve formulated by Egypt on the subject of Fifth Freedom rights. A final decision in this respect has not yet been taken by the British.

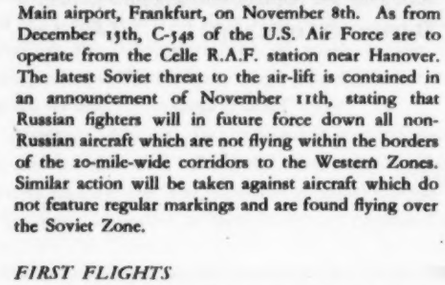
Berlin Air-Lift:

● Up to October 25th, 1948, thus during the first four months of the Berlin air-lift, British and American aircraft flew 446,684 tons of supplies to the ex-capital: American aircraft carried 310,994 tons and British aircraft, 135,690 tons. Increased numbers of U.S. aircraft participating in this operation are to use R.A.F. bases situated in the British Zone. Two U.S. Navy transport squadrons, comprising 24 Douglas R5D four-engined transports (Navy version of the C-54 "Skymaster"), are being assigned to the Berlin air-lift from the Pacific. They represent the first instalment on 66 additional C-54s authorised by Washington for the air-lift. The first six of these aircraft arrived at Rhein-Main airport, Frankfurt, on November 8th. As from December 15th, C-54s of the U.S. Air Force are to operate from the Celle R.A.F. station near Hanover. The latest Soviet threat to the air-lift is contained in an announcement of November 11th, stating that Russian fighters will in future force down all non-Russian aircraft which are not flying within the borders of the 20-mile-wide corridors to the Western Zones. Similar action will be taken against aircraft which do not feature regular markings and are found flying over the Soviet Zone.

FIRST FLIGHTS

● The prototype of the McDonnell XF-88 "Voodoo" twin-jet fighter made its first flight at Muroc Air Force Base, California. It is armed with six 20-mm. cannon in the nose. Span is 40 feet, length 50 ft., gross weight about 15,000 lbs., and maximum range 2,100 miles.

● The Chance-Vought XF7U-1 twin-jet fighter has started its flight test programme at the Naval Air Test Centre, Patuxent River, Maryland.



SE 3000.

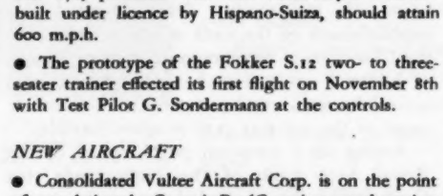
● SNCA du Sud-Est, the French aircraft concern, has started flight-testing its SE 3000 helicopter.

● The NC 271, a flying scale model of the NC 270 twin-jet experimental aircraft and powered with a Walter HWK 109-509 bi-fuel rocket motor, is undergoing flight tests at the Brécy test centre, Orleans. The NC 271 is carried aloft by a four-engined "Languedoc 161" and should attain a speed of 560 m.p.h. with the assistance of the Walter rocket motor. The NC 270, powered with two Rolls-Royce "Nenes" built under licence by Hispano-Suiza, should attain 600 m.p.h.

● The prototype of the Fokker S.12 two- to three-seater trainer effected its first flight on November 8th with Test Pilot G. Sondermann at the controls.

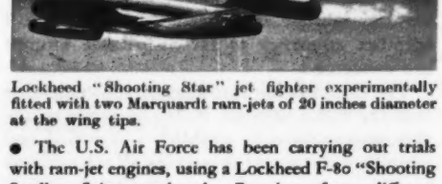
NEW AIRCRAFT

● Consolidated Vultee Aircraft Corp. is on the point of completing the Convair B-36C, an improved version of the Convair B-36 six-engined bomber. Power will be furnished by six Pratt & Whitney R-4360 VDT compound engines which will have a lower fuel consumption than the ordinary engine, resulting in an increased range estimated at 12,000 miles.



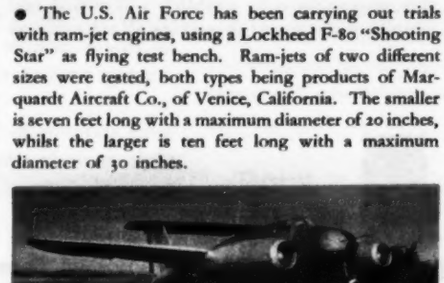
Lockheed "Shooting Star" jet fighter experimentally fitted with two Marquardt ram-jets of 20 inches diameter at the wing tips.

● The U.S. Air Force has been carrying out trials with ram-jet engines, using a Lockheed F-80 "Shooting Star" as flying test bench. Ram-jets of two different sizes were tested, both types being products of Marquardt Aircraft Co., of Venice, California. The smaller is seven feet long with a maximum diameter of 20 inches, whilst the larger is ten feet long with a maximum diameter of 30 inches.



NC 1071 torpedo bomber developed by SNCA du Centre, fitted with two Rolls-Royce "Nene" turbo-jets built under licence by Hispano-Suiza.

● North American Aviation, Inc., is developing a multi-engined carrier-borne bomber designated North American A2J-1. It will be larger than the twin-engined North American AJ-1.



Piaggio P.136 amphibian, fitted with two 115-H.P. Franklin flat-six engines.

● Lockheed Aircraft Corp. is working on the prototype of the Lockheed XP2B-4 "Neptune," an aircraft developed from the P2V twin-engined long-range bomber and powered with two Wright "Turbo-Cyclone 18" engines developing 3,400 H.P. for take-off and rated at 3,200 H.P. for 30,000 ft. altitude. The Lockheed XP3B, a projected bomber powered with propeller-turbines, is being studied by Lockheed.

Convair XP5Y-1.

● The first prototype of the Convair XP5Y-1 four-engined patrol bomber flying-boat has been completed. Power is furnished by four Allison T-40 propeller-turbines, each delivering a take-off power of 5,000 H.P. plus 800 lbs. thrust, and driving a pair of contra-rotating Aero-Products propellers of 15 ft. diameter. The P5Y is designed for long-range bombing, anti-submarine patrol, photo-reconnaissance and aerial survey, troop and cargo transport. Cruising speed is 210 m.p.h. at 25,000 ft., and the aircraft can carry a military load of ten tons over a range of 4,600 miles.

● Monsted-Vincent Aeronautical, Inc., has completed the prototype of a four-engined executive aircraft, the "Star Flight," and has started its flight test programme at New Orleans Airport. Fitted with a retractable nose-wheel undercarriage, the new aircraft is powered with four 85-H.P. Continental engines driving pusher propellers.

● The de Havilland Aircraft Co., Ltd., is developing a new twin-engined jet fighter. The aircraft is stated to have a fuselage similar to that of the D.H. 100 "Vampire" and to feature a swept-back wing. Engines will probably be D.H. "Goblin" or "Ghost" turbo-jets.

● The Cierva W.14 "Skeeter" two-seater helicopter, now undergoing flight tests, has a single three-blade main rotor and a three-blade tail rotor. Control is effected in the normal manner by collective and cyclic pitch variation. Thanks to the extreme simplicity of the design, Cierva Autogiro Co., Ltd., hopes to market the "Skeeter" for less than £3,000, provided sufficient orders are received.

Cierva W.14 "Skeeter."

● The first Nord 1400 "Noroit" twin-engined reconnaissance flying-boat, built at the Le Havre works of SNCA du Nord, was launched on November 10th. A batch of 25 of these aircraft is now in production for the French naval air service.

POWER PLANTS

● Rolls-Royce Ltd. is developing a new turbo-jet engine of 8,500 lbs. thrust.

● Svenska Flygmotor A.B. and Svenska Turbinfabriks A.B. Ljungström (STAL) are testing prototypes of two new turbo-jet engines of Swedish construction. The unit developed by Svenska Flygmotor has a two-stage centrifugal compressor, an annular combustion chamber and a four-stage turbine. The STAL engine is of axial-flow design.

* Excerpts from Nos. 1561-1580 (October 26th to November 20th, 1948) of "Interavia Air Letter," an aeronautical digest published five times weekly, with photo service, in separate English and French editions.

INDUSTRIAL NEWS

● Contracts resulting from the USAF Seventy-Group Programme are causing the U.S. aircraft-manufacturing industry to make substantial additions to its labour force before starting production of the new aircraft on order. Republic Aviation Corp., which is entirely engaged in military contracts, is already approaching peak production. Grumman Aircraft Engineering Corp. should be in full production by mid-1949, whilst Boeing Airplane Co. and North American Aviation, Inc., will probably not attain peak production until 1950.

● The de Havilland Aircraft Co. is engaged in an extensive helicopter programme. A considerable amount of rotor development work has already been undertaken, and the present programme is devoted to a ram-jet design.

● Production of de Havilland D.H. 100 "Vampire" jet fighters under licence in Italy has been discussed by representatives of the British and Italian air authorities. The scheme is still in the exploratory stage and no definite arrangements have yet been made.

INDUSTRIAL PERSONALITIES

● George Herbert Miles, formerly Technical Director and Chief Designer of the now defunct Miles Aircraft Ltd., has been appointed Assistant Chief Designer of Airspeed, Ltd., whose Chief Designer is A. E. Hagg.

G.H. Miles.

● Jean Lacoste, former Managing Director of Société Française Hispano-Suiza, the French engine firm, died at the age of 87 at his Neuilly home near Paris.

AIR TRANSPORTATION

Intercontinental :

● Trans World Airline was recently named the world's largest airline, in terms of scheduled miles flown, by a CAB study. T.W.A. ranked first amongst international scheduled trans-Atlantic carriers in the volume of east-bound traffic during the third quarter of 1948 by flying 21 per cent. of all east-bound trans-Atlantic air passengers on scheduled services during the quarter. On west-bound flights, T.W.A. carried 18 per cent. of all passengers.

● Pan American World Airways inaugurated its service from New York to Barcelona on November 8th, about three weeks later than originally planned. There are two round flights weekly via Boston, Santa Maria (Azores) and Lisbon.

● British South American Airways' winter schedules will provide for additional operations with Avro "Tudor IV" aircraft, which have hitherto only flown as far as the Caribbean area. Under the new timetable these aircraft will operate a through service from London to Santiago de Chile via Keflavik, Gander, Bermuda, Kingston, Barranquilla and Lima. "Tudor IVs" will also link the East Coast Avro "York" service with Santiago by providing a weekly shuttle flight from Buenos Aires to Santiago. When the new schedules are introduced all Avro "Lancastrian" aircraft will be taken off passenger schedules, which will be operated exclusively with "Tudor IVs" and "Yorks."

● The BOAC flying-boat service from London to Iwakuni, in the British Commonwealth Occupation Zone of Japan, is being extended to Tokyo. A proving flight to the Japanese capital, prior to inauguration of a regular weekly service, was made on November 13th.

● The Brazilian Government has authorised landing rights for Alitalia at Natal and Rio de Janeiro on the Italian carrier's Rome—Buenos Aires service. Alitalia runs a weekly schedule to South America with Avro "Lancastrians."

● Swissair has concluded a reciprocal agency agreement with Aerovias Guest for the transport of air freight. The Mexican company at present operates a twice-weekly service from Mexico City to Madrid via Miami, Bermuda, The Azores, and Lisbon.

● Air Ceylon is purchasing three Douglas DC-4s in the United States for use on its projected long-distance international services to London and Australia. The company will operate these routes through a subsidiary known as Air Ceylon International.

● Sabena's winter timetable lists the following services from Brussels : London, thrice daily on weekdays and twice daily on Sundays ; Amsterdam, twice daily on weekdays and once on Sundays ; Hamburg, twice weekly ; Frankfurt, twice weekly ; Paris, daily ; Nice, four times weekly ; Milan, four times weekly ; Rome, twice weekly ; Madrid—Lisbon, weekly ; Hamburg—Copenhagen, twice weekly ; Amsterdam—Copenhagen—Stockholm, five times weekly ; Basle, thrice weekly ; Geneva, weekdays ; Zurich, four times weekly ; Prague, four times weekly ; Athens, weekly ; Athens—Cairo—Luxor—Juba—Stanleyville, weekly ; Leopoldville, thrice weekly ; Elizabethville, weekly ; Johannesburg, weekly ; New York, weekly.

Europe :

● Air France has started twice-weekly services between Paris and Madrid, Paris and Barcelona.

● Det Danske Luftfartselskab, the oldest airline in Europe, celebrated its 30th anniversary on October 29th. — Aero O/Y, the Finnish airline, celebrated its 25th anniversary on November 1st.

● Iceland's Loftleidir H/F airline is now operating regular services between Reykjavik and Paris, as well as charter flights to Italy.

● Polskie Linje Lotnicze, the Polish airline, announces that it will provide a weekly through service from Belgrade to Copenhagen via Budapest and Warsaw.

Miscellaneous :

● American Airlines will keep its Douglas Dc-3s in service until May, 1949, by which time a number of smaller airports will have been expanded to be adequate for "Convair-Liner" equipment. The company plans to retire all its Douglas DC-4s from passenger service by the end of 1948 ; some of them will subsequently be switched to all-cargo operations.

● Changes in British Overseas Airways' fleet reduced the number of aircraft from 123 on November 1st, 1947, to 105 on October 1st, 1948. The latter figure includes the following landplanes : 27 Avro "Yorks" 22 Douglas DC-3s, 13 Avro "Lancastrians," 10 Lockheed" Constellations," 6 Convair "Liberators," 1 D.H. "Dove" and 1 Miles "Gemini" ; the flying-boat fleet comprises 26 Short "Sandringhams" and 9 Short "Solents." Eight aircraft of the above list are used exclusively for training (including 3 "Yorks" and 1 "Lancastrian").

● Scandinavian Airlines System will receive the first of its four Boeing "Stratocruisers" in May or June, 1949, and the remainder by the end of the year.

● Air Express Transports, a Paris charter carrier which operates three Curtiss C-46 "Commando" twin-engined transports, reportedly plans to purchase Mauboussin CM-10 gliders to form aerial trains for transporting freight.

GROUND ORGANISATION

● The new airfield at Tegel in the French sector of Berlin has now been completed and opened to commercial air traffic. — Several military air bases in the Russian zone of Germany are being expanded. Work is proceeding at Brandis, Saxony ; Falkenberg, near Dessau ; and at Polenz, near Leipzig. More than 3,000 workers are engaged in the expansion of Sc..önefeld Airport in the Russian sector of Berlin.

AIRLINE PERSONALITIES

● During the night of October 21st, 1948, a "Constellation" of KLM Royal Dutch Airlines crashed near Prestwick Airport, Scotland. Among the 40 victims were two KLM officials who had seen over twenty years in service with the airline and contributed notably towards its development :

The 49-year-old Vice-President of KLM, Hendrik Veenendahl, was a close friend of the company's founder and President, Dr. Albert Plesman. KLM owes to Veenendahl its post-war re-equipment with modern U.S. flying equipment and the rapid rehabilitation of Schiphol airport, Amsterdam.

The late Hendrik Veenendaal, Vice-President of K.L.M.

Captain Koene Dirk Parmentier became known throughout the world after his Mildenhall—Melbourne flight in the 1934 McRobertson Race. Chief of KLM's flying services, Parmentier made the first post-war flights to the Netherlands East Indies and to South Africa. He played an important part in building up the airline's staff of pilots.

The late Captain Parmentier, photographed in conversation with K.L.M. President A. Plesman.

SERVICE AVIATION

● Three de Havilland D.H. 100 "Vampire" jet fighters have been delivered to the Royal Indian Air Force.

● The Italian air staff has worked out a re-equipment programme for the Air Force, which is to be spread over four years and to run parallel to the civil aviation reconstruction plan. The following categories of aircraft are to be acquired : jet-propelled fighters (built under licence) ; fighter trainers (derived from first-line types used by the Italian Air Force towards the end of the war) ; multi-engined transports ; liaison aircraft ; helicopters ; air-sea rescue flying-boats ; primary and basic trainers. Contracts are to be awarded exclusively to the Italian industry.

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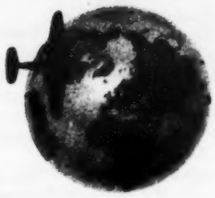


Marginal Notes

Hibernation

During the pioneer years, winter lay-offs for the airlines were unavoidable, generally practised, and more or less insignificant. Insignificant, because an operator-pilot who pushed his Fokker F-7 into the hangar as soon as the autumn leaves began to fall, in order to put it into service again once the March sun appeared, suffered losses which amounted to no more than the hangar rent and, at the most, three or four months' wages for his mechanic.

Such hibernation would cost a lot of money nowadays. The continually increasing overhead costs of the airline companies still go on, whether it rains or snows. Moreover, the operating costs can only be limited by a small extent, for in the course of the years civil aviation has become a public service and is obliged to maintain a certain business level in the interests of general economy. It is no wonder, therefore, that nearly all air carriers sally forth well wrapped up into the cold season, in order to re-appear more scantily clad in spring.

Certain optimists expect miracles to happen : the November, 1948, timetables of the U.S. airline companies, compared with the summer timetables, feature no restrictions worthy of mention, and initiated circles have thereupon built up the hope that the 1948-49 winter will bring forth better results than the winter of the preceding year.

We are the last people who would wish to darken civil aviation's sunny horizon, unless it were absolutely necessary. But it might be wiser not to allow our hopes to soar too high. Timetables do not mean that the flights are all accomplished, and accomplished flights do not mean that the anticipated profits have been raked in.

As a matter of fact, the majority of airline managements seem to share this opinion. Just as in former years, companies are equipping themselves for the winter, undertaking every step that might restrict eventual losses and contribute towards an increase in turnover.

As usual, the winter fares have been decreased considerably. A number of American and European carriers are offering winter excursion tickets, with round trips costing 1 $^1/_3$ of the single fare, tickets being valid for thirty days. Thus British South American Airways is offering thirty-day winter excursion fares between November 1st, 1948, and April 30th, 1949, for its services to the Carribbean and the West Coast of South America. Air France has introduced winter excursion fares for the Glasgow—Paris—Nice—Rome route. KLM Royal Dutch Airlines is issuing half-price tickets to children aged twelve to eighteen at school in Europe who visit their parents in countries outside Europe (or vice versa). Finally, supplements for sleeper accommodation on Atlantic flights have been reduced considerably.

All these measures can, of course, attract new customers to airline travel, but they do not constitute a cure-all.

Fundamentally, not much will be gained by adopting such procedures for the winter season alone. Definite changes are only to be expected from more radical measures. In this respect we are reminded of suggestions by the IATA Director-General, Sir William P. Hildred, who urges the introduction as soon as possible of a tourist class throughout international civil aviation. A step in this direction may be taken by the Air Transport Association of America, which is expected to launch a long-term air transportation propaganda campaign in the near future, and has already endorsed a three- to five-year advertising programme scheduled to cost between $500,000 and $750,000 annually.

The President of KLM Royal Dutch Airlines, Dr. Albert Plesman, who has been appointed 1949-50 IATA President, is also in favour of ahead planning. His obituary notice on the death of KLM's Vice-President, H. Veenendahl, terminates with the significant words : "Forwards with caution and devotion !"

Jets in Action

Writers who take their work seriously have a habit of stating, each time they describe a new invention, that we are again on the threshold of a new technical era, and that before very long our daily lives will be the scenes of revolutionary developments and changes. We have become so used to such prophecies that we generally believe every word of them. This requires the least mental effort and, moreover, each man can divert a small part of the glory of his brilliant contemporaries to himself, for, after all, one is not a contemporary without reason.

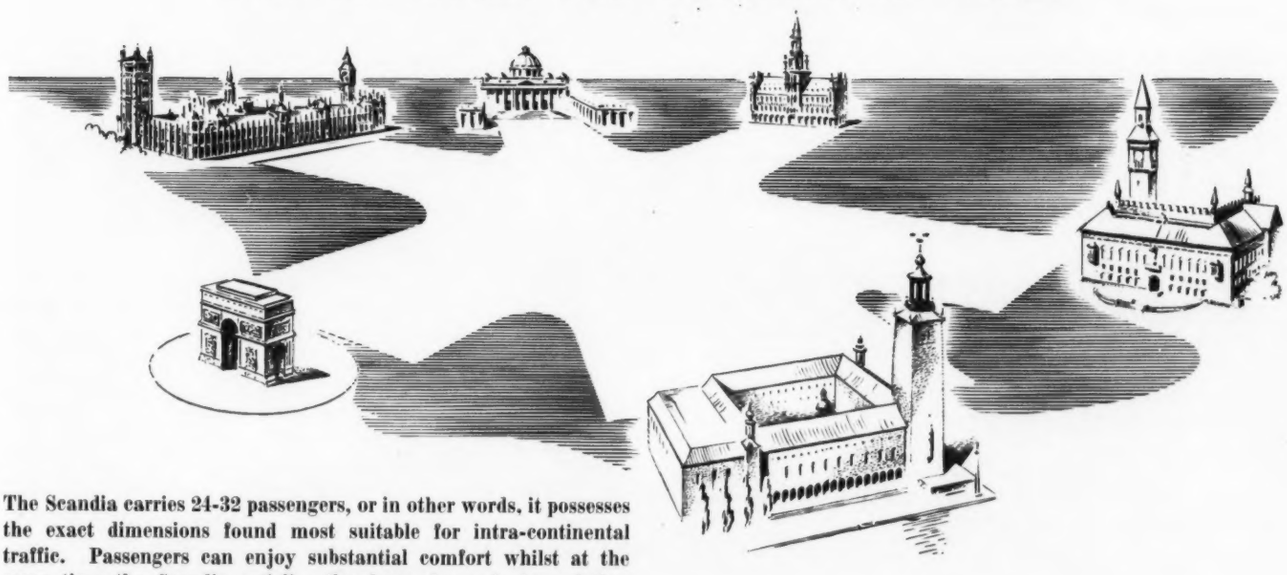
Just as the passive sportsman proudly stalks into the bar on a Saturday night if his favourite team has won a game, so the Babbitts of all countries are pleased about the perfectly natural progress made in science, and believe unreservedly what the newspapers tell them in glaring headlines. They have completely forgotten how to form their own judgment and where to draw the line between sensation and truth.

In this connection there is scarcely a domain which gives more food for earnest thought than that of the scientific discoveries of recent years and their forthcoming applications. As a rule, scientists engaged in practical work become all the more reserved as they attain higher positions in the hierachy of their profession. If a man of this calibre once lifts the veil of secrecy—and which inventions of our day are not of importance to the national defence and therefore secret ?—then we have every reason to prick up our ears and listen attentively. And if it concerns an aeronautical expert like Professor Fritz Zwicky, who is not only Director of Research for Aerojet Engineering Corp., but also Astrophysicist at the California Institute of Technology, then any word he might choose to utter is to be taken seriously. This applies even if his prophecies seem to border on fantasy, and convey to the uninitiated no clear idea of the nature of his projects.

Professor Zwicky recently stated that potentially no less than 576 different types of jet engine are within the reach of practical production, although no more than a handful are now under development. Most exciting in the near future, he anticipates, will be non-aviation types, and he predicts that within our time, we will have a "terra jet" that will drill straight through the earth. And in addition to this Jules Vernian mechanical mole, Professor Zwicky has lifted the curtain slightly on the fully-developed but heretofore secret "hydro pulse" — a jet engine which operates under water. Working on principles similar to those of the resonance duct (the power plant of the German V-1 "doodlebug" comes to mind), this engine gives rise to periodic explosions in a combustion chamber by mixing an oxygen carrier with a reactor—in the present case by mixing sea water and molten sodium. Contrary to the V-1, the "hydro pulse" cycle is very rapid (Zwicky refers to it as being "hellishly fast") and should be capable of driving a vehicle under water at a speed of 100 knots.

The question of what purpose such a device could serve and possibly will serve would be out of place here. We wish merely to point out the pleasing fact that the still very young science of aeronautics, with the engines it has developed, is on the point of reaching into other, completely disassociated domains and thereby paying back those loans which it took up in its pioneering days.

EXACTLY RIGHT FOR CONTINENTAL FLIGHT



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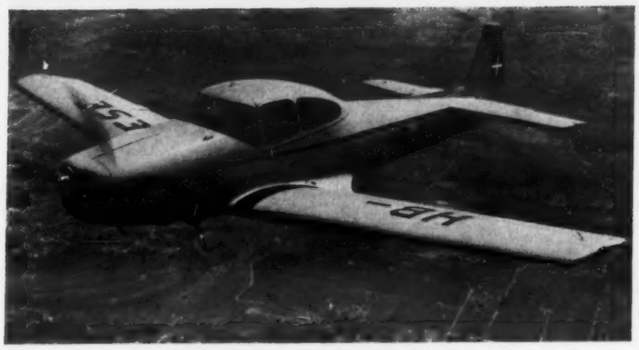

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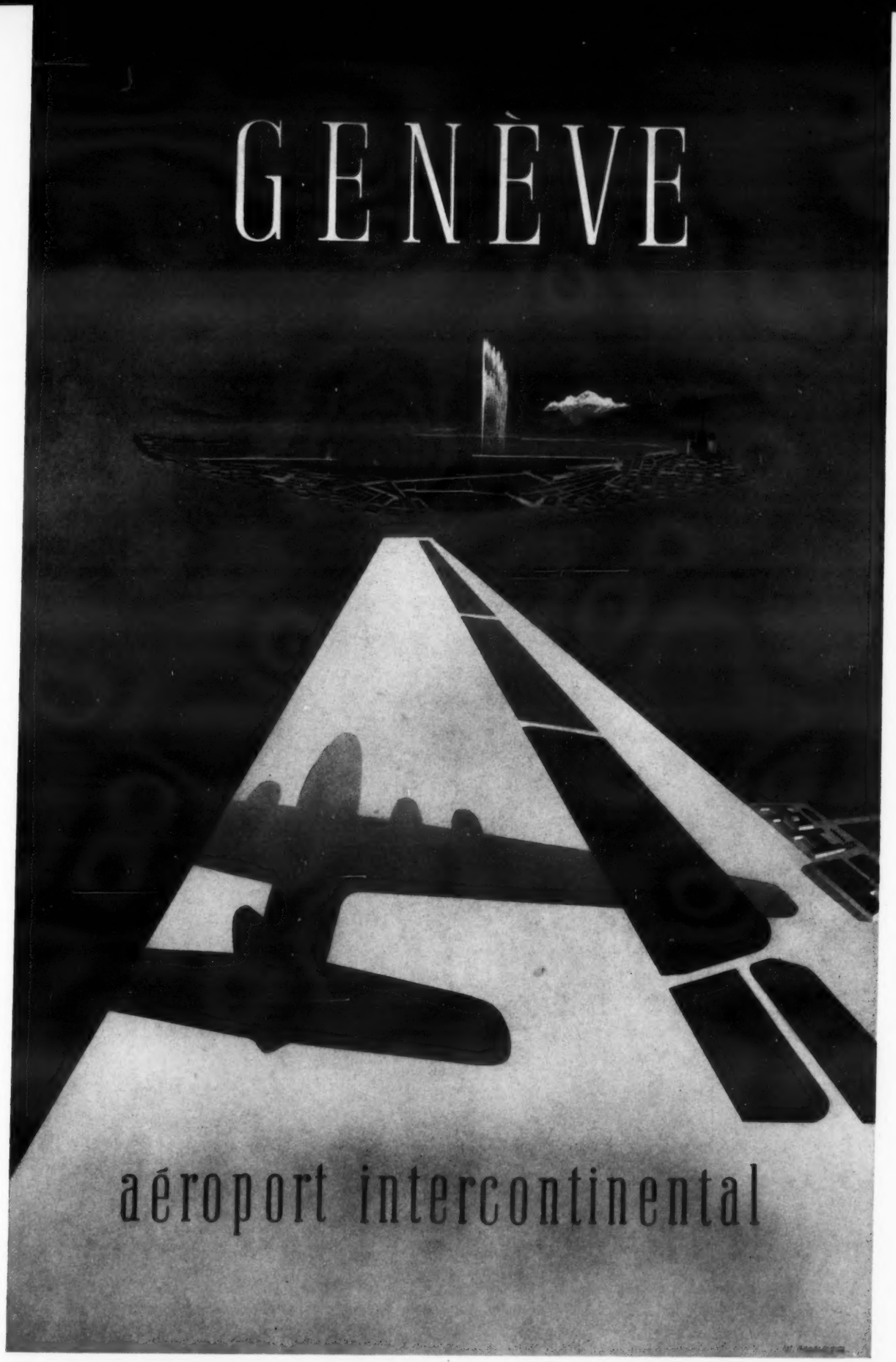

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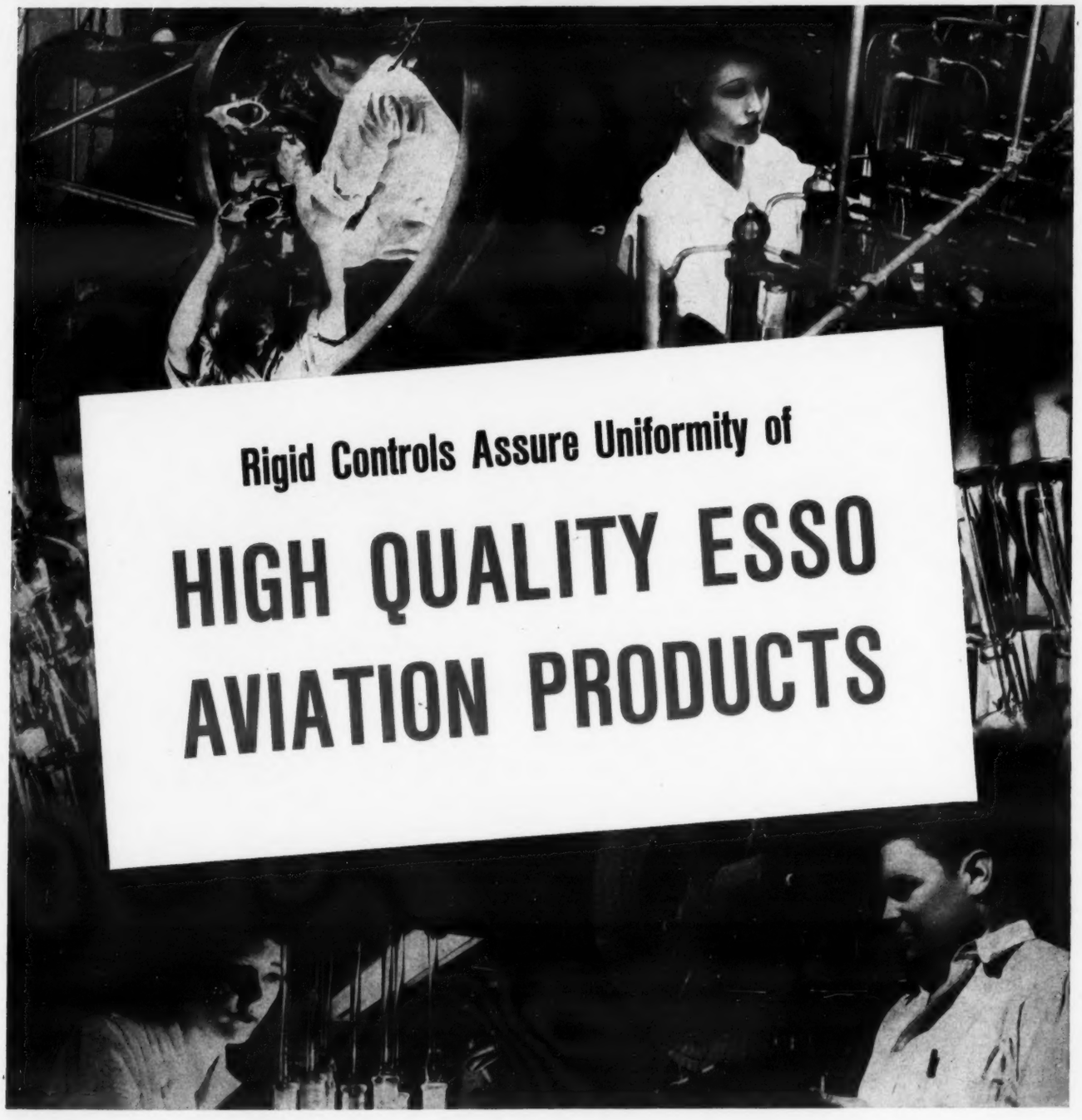

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